Operating and service manual
Controlled Atmosphere

Star Cool refrigeration unit Model SCI - XX - X - CA

24-hour hotline support

Call us at +45 7364 3500 or send us an e-mail at service@starcool.dk. Our service department is available 24 hours a day, 7 days a week - providing easy access to the answers you need.

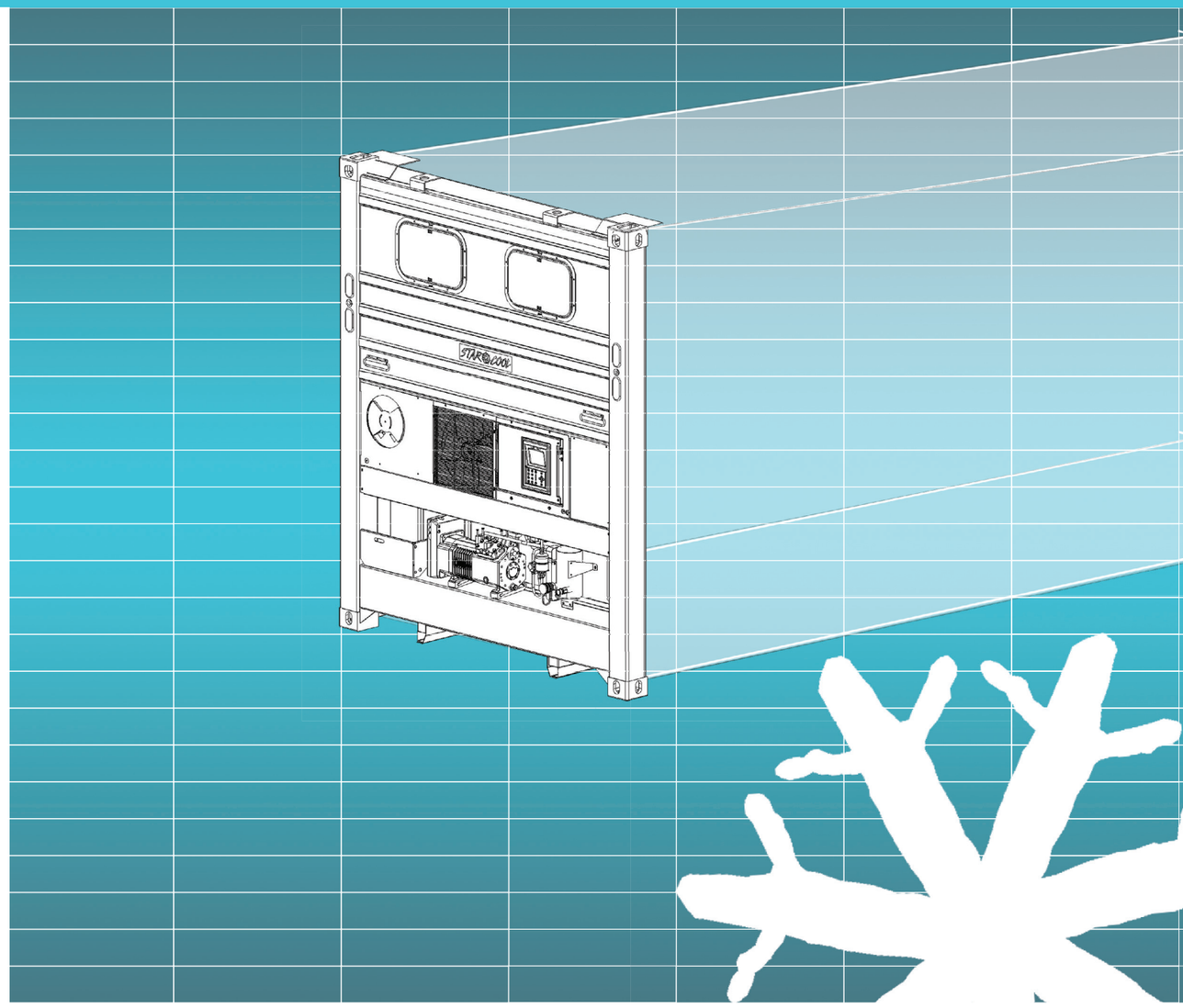
Guideline: Order procedure

Purchase spare parts for the Star Cool reefer machine fast and reliable via the internet.

Customers, service providers and other repair shops order directly from Star Cool. Vessels shall contact the relevant customer (shipping line) for ordering.

All orders are placed centrally with Star Cool where our staff will assign the order to the distribution centre located closest to the required delivery address and arrange shipment from there.

To be able to order spare parts from www.starcool.dk, please register at the site, to receive a login and password.



Bjerndrupvej 47
6360 Tinglev, Denmark
Phone: +45 73 64 34 00
Fax.: +45 73 64 35 69
E-mail: starcool@starcool.dk
www.starcool.dk

STAR COOL
... Cool Thinking!

Version 810800A - Dec 2010

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Preface

The Star Cool CA is a controlled atmosphere system designed to prolong the shelf life of perishables by regulating the internal atmosphere of the container. The container's atmosphere obtains the desired gas composition based on entered set points for O2 and CO2 via the controller.
The desired atmospherical composition of the gas serves to lower the respiration of the perishables, and thereby providing a prolonged shelf life.

ATTENTION! Due to regulation of the cargo atmosphere during transport, oxygen level may be low and/or carbon dioxide level high inside the container! Please check gas levels and flush with fresh air before entering and unloading. Exposure to low oxygen/high carbon dioxide may cause loss of consciousness and suffocation.

This version of the manual is dated December 2010, edited by Maersk Container Industry AS.
All rights reserved. This user's manual is valid for software version 0345 or newer versions.
The information herein is subject to change without notice and does not represent a commitment on any part of Maersk Container Industry AS.
While the information herein is assumed to be accurate, Maersk Container Industry AS assumes no responsibility for any errors or omissions that may appear in this documentation.

This manual is valid for:

Model	SCI - XX - X - CA
Release Date	01.12.2010

Warnings

Do not operate or maintain this refrigeration unit until you have familiarized yourself completely with the equipment and operating of this unit by reading the instruction in this addendum and the Operating and service manual for Star Cool units.

Do not enter the container - including opening the service hatches - when oxygen level is below 20.9%.

Do not perform any welding on the unit before disconnecting the power plug.

Disconnect main power supply to unit before inspecting the interior of the controller box.

The unit is charged with R134a and ester oil BSE 55. Do not use any other refrigerant or oil.

Do not use contaminated refrigerant or oil.

Do not release R134a into the atmosphere. Use recovery equipment according to present legislation.

During maintenance please observe that R134a is operating with high and low temperatures in combination with high pressures, which may cause personal injuries if not handled properly.

During recovery and maintenance of R134a unit personal protection equipment has to be worn.

Do not trap any liquid refrigerant inside pipes during soldering work. This may lead to explosion of pipe.

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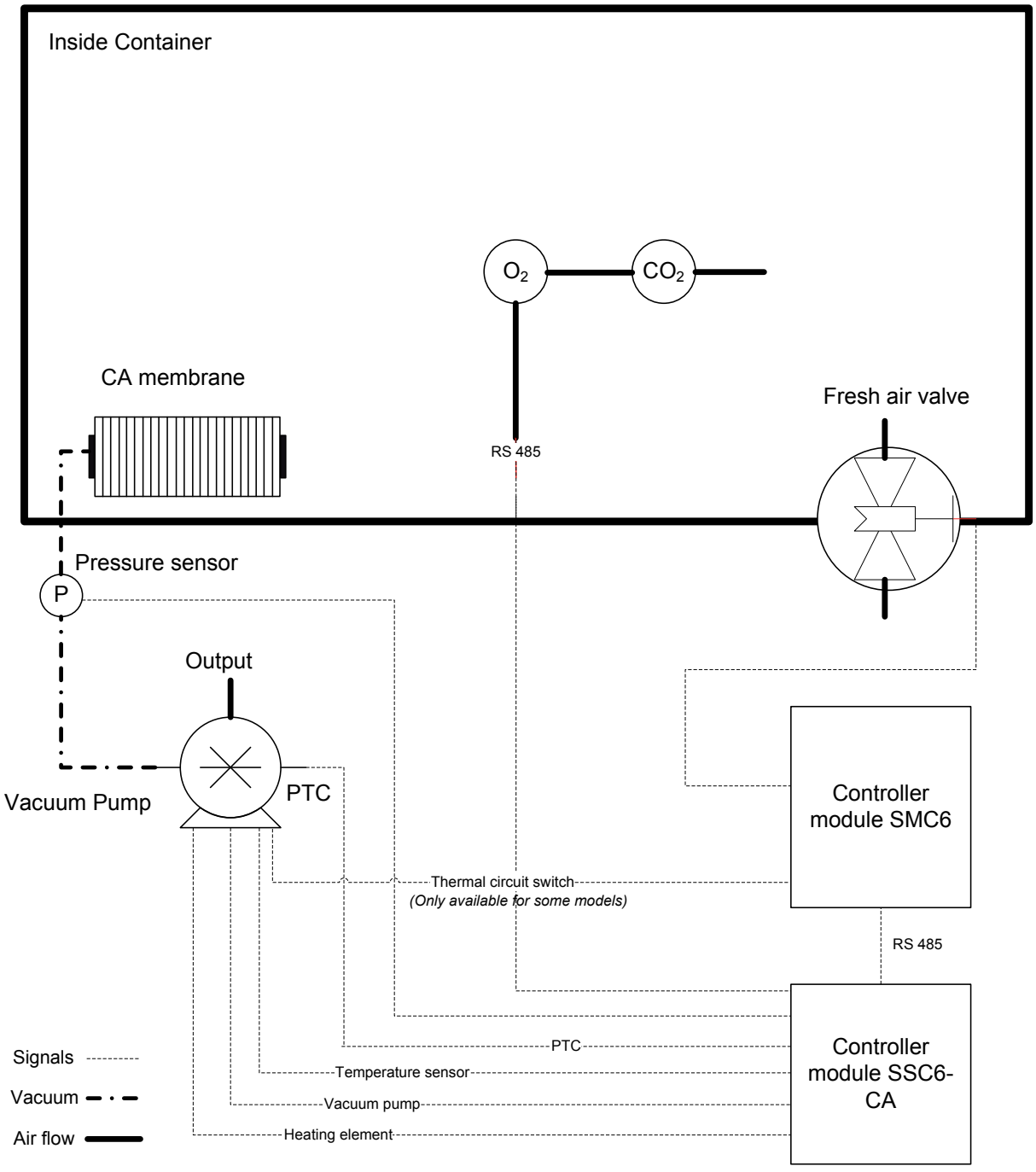
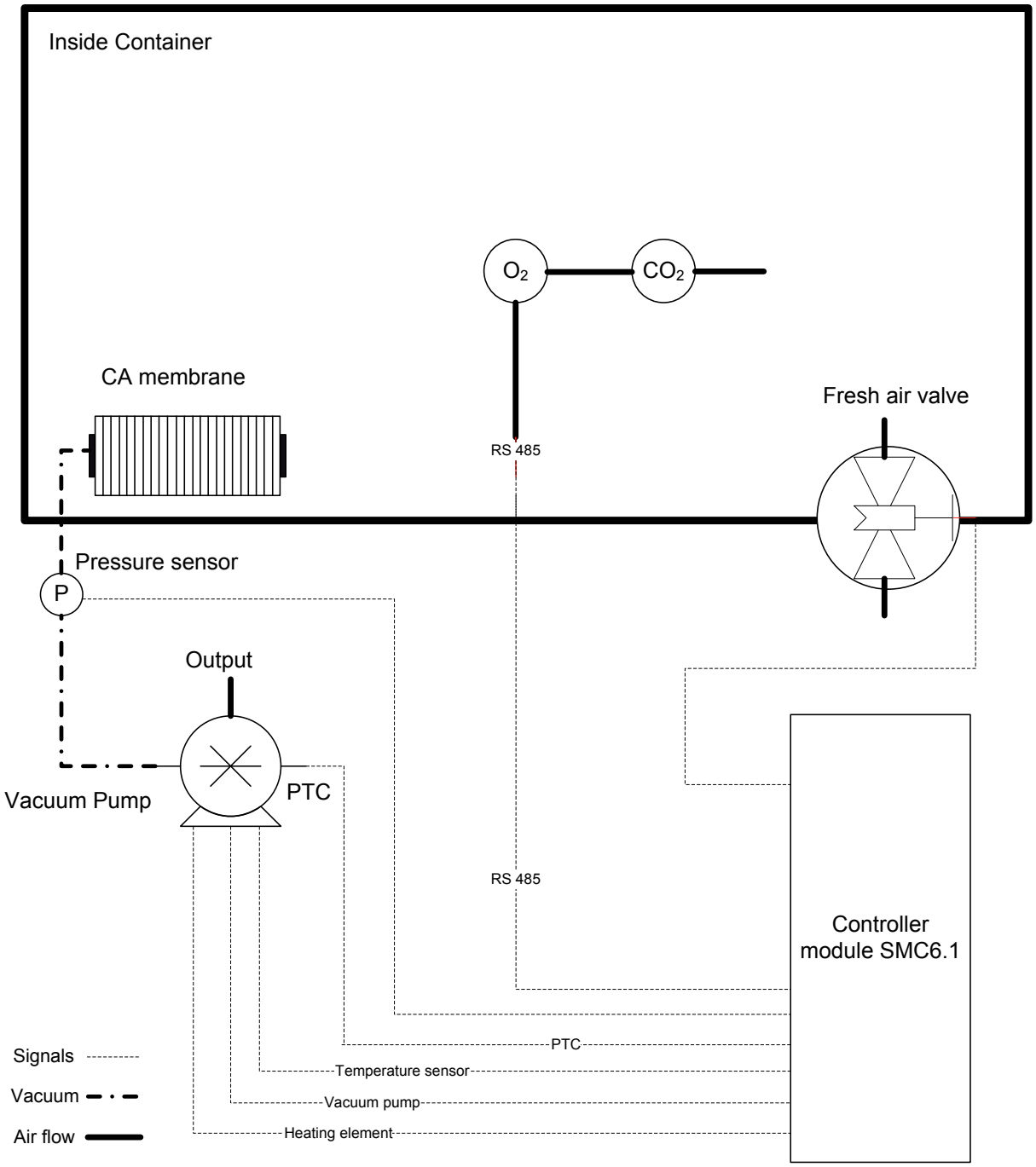
Legend

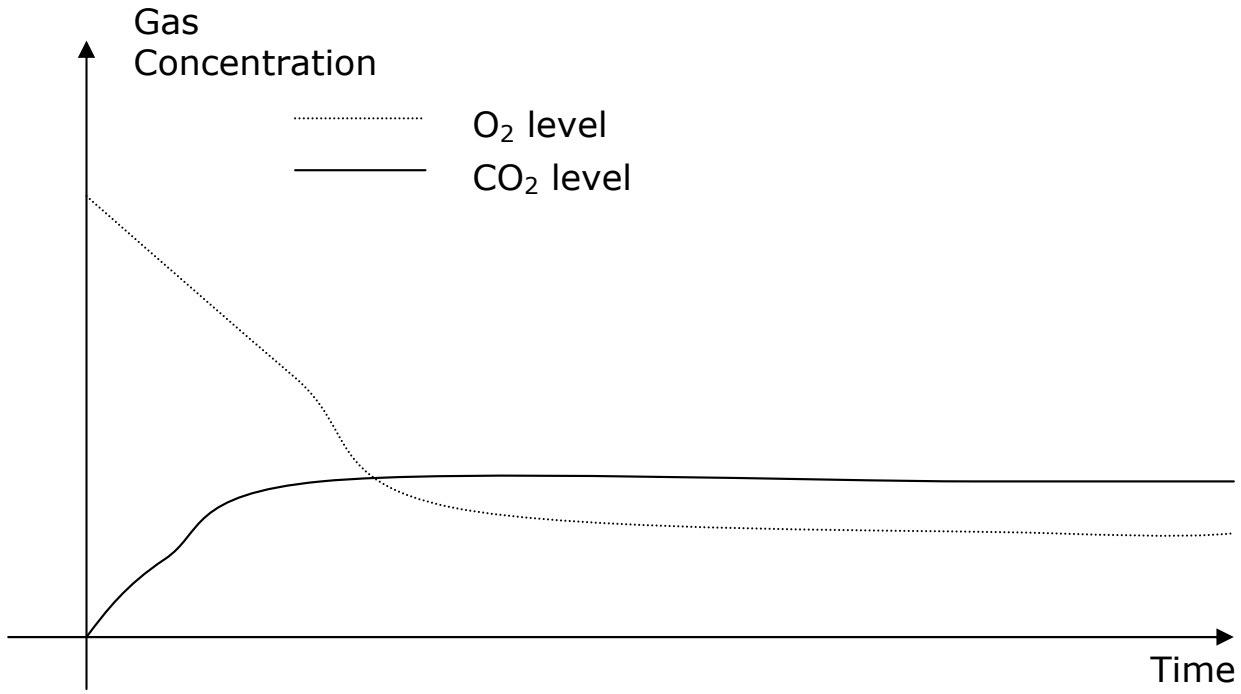
Short name	Name
Pmem	Membrane pressure
Tpump	Vacuum pump temperature
Mpump	Vacuum pump
Hpump	Heating element
Mair	Fresh air motor

CA function overview - two versions




Inside Container
O2
CO2
CA membrane
Fresh air valve
RS 485
Pressure sensor
P
Output
Vacuum Pump
PTC
RS 485
Controller
module SMC6.1
Signals
Vacuum
Air flow
PTC
Temperature sensor
Vacuum pump
Heating element

The basic principle is that the fruit will generate CO2 from O2 via respiration. This will increase the CO2 level and decrease O2 level inside the container. When the CO2 level reaches above the CO2 set point the vacuum pump will activate and evacuate CO2 with the selective membrane. In case the O2 level goes below the O2 set point the fresh air valve will open and let in ambient air (20,9% O2). This described mechanism will regulate the gas concentration within the container as illustrated below:



Warning

Due to low oxygen levels inside the container, ventilation is necessary before entering, either for repairing the unit or unloading. Stay away from doors while venting.

Container venting procedure

TO BE PERFORMED WHENEVER ENTERING THE UNIT/CONTAINER IS NECESSARY

1. Press for operation and select O03 and set Air flow mode to "NORMAL".
2. Open fresh air module fully. AL 834 may appear.
3. Wait for O2 level to reach 21% +/- 2% before entering.
4. Close air module and clear AL 834.

General specification

Additional components to a standard unit:

- O2 sensor
- CO2 sensor
- Vacuum pump
- Membrane
- Vacuum hose
- Fresh air module incl. motor

Fresh air motor

Type	Gear motor
Supply	12-24 V DC

CO2 sensor

Type	Nondispersive infrared sensor
Operating range	0 - 20%

Accuracy	CO2 (5%) +/- 0,3% CO2 (0,5%) +/-0,1%
Supply	8-15V DC
Output	RS-485

O2 sensor

Type	Ziconium Oxide
Operating range	0 - 21%
Accuracy	At O2 (3%) +/- 0,5%, temperature ranges from -1 - 15°C
Supply	8-15V DC
Output	RS-485

Pressure transmitter

Type	Ratiometric
Operating range	-1 - 0 Bar
Accuracy	±10 mBar
Supply	5V DC
Output	Ratiometric

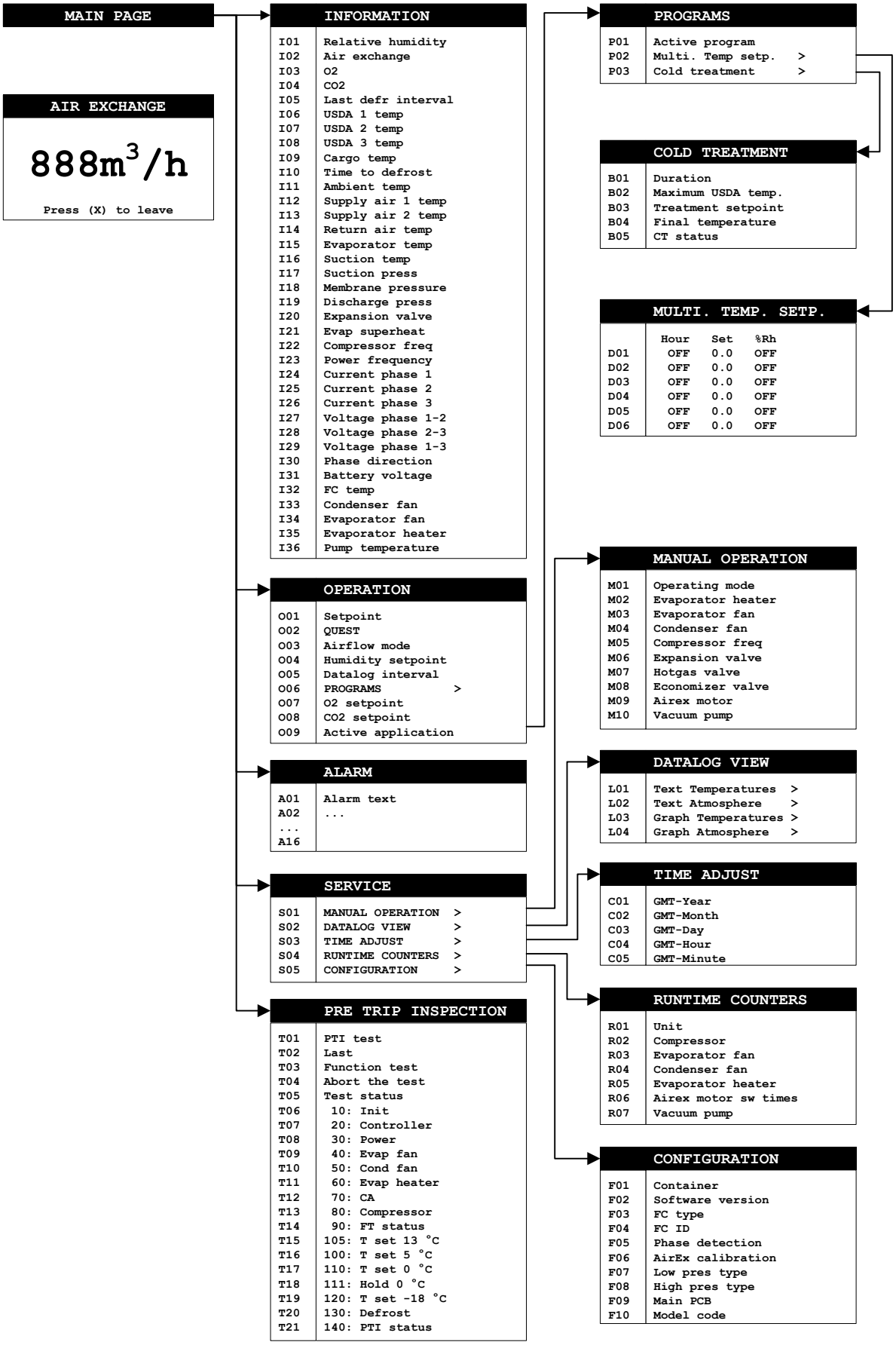
Temperature sensor

Type	NTC, 10 kOhm at 25°C (77°F) 10K3A1
Operating temp.	-40°C to 100°C (-40°F to 212°F)
Accuracy	±0.15°C, range -30°C to 100°C (±0.5°F, -22°F to 212°F)

Vacuum pump, including heating element

Capacity	16 m^3/h at 50 Hz and 19 m^3/h at 60 Hz
Supply	3 phase AC 50 Hz 340 – 460 Volts and 60 Hz 400-520 Volt
Oil (type/amount)	Anderol FGC 32 - 0.35 L

Menu structure



Setpoints

Setpoints are entered via the operation menu

O2 range 3 - 21%
CO2 range 5 - 12%

Setting setpoint: O2 level is set in O07 and CO2 level is set in O08 (Menu structure)

CA function on/off

If the setpoints for O2 and CO2 is set to OFF the CA function is turned off

Additional menu information for CA

In addition to the standard log the following information can be viewed in the log:
Please note that it will take approx. 5 minutes before CO2 and O2 can be viewed in the display.

I03 O2 level

Function:

Shows the O2 level [%]

Value:

An actual value of the O2 level inside the container.

I04 CO2 level

Function:

Shows the CO2 level [%]

Value:

An actual value of the CO2 level inside the container.

I18 Membrane pressure

Function:

Membrane pressure.

Value:

Actual vacuum pressure between vacuum pump and membrane. Under normal conditions: 40-100 mBar.
StarView enables the display of the following additional information.

O07 O2 set point

Function:

O2 set point.

Value:

-

O08 CO2 level

Function:

CO2 set point.

Value:

-

Data log

CA CO2Set	CA O2Set	Input CO2	Input O2	Input Pmem	Input Tpump	Application CAType	Control MpumpCA	Control HpumpCA	Control MairPct [%]

Title	Info displayed	
CO2Set	CO2 set point [%]	
O2Set	O2 set point [%]	
Input CO2	CO2 level [%]	
Input O2	O2 level [%]	
Input Pmem	Membrane pressure [mBar]	
Input Tpump	Oil temperature in the vacuum pump [°C]	
Application CAType	0 = CA off	1 = CA on
Control MpumpCA	0 = vacuum pump off	1 = vacuum pump on
Control HpumpCA	0 = heating element off	1 = heating element on
Control MairPct (time opened [%])	0 = fresh air valve closed	100 = fresh air valve open

Warning

Do NOT enter the container, including opening the service hatches, when the oxygen level is below 20.9% (equal ambient air).

Human response to oxygen low atmosphere:

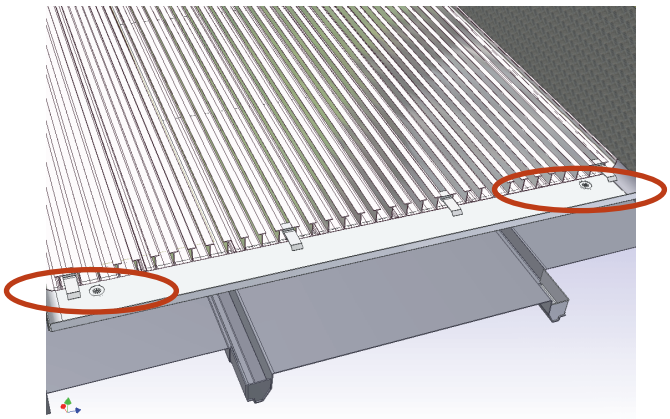
Oxygen content of Air	**Symptoms of a person exposed**
20.9%	Level in ambient air - no effect
15% - 19%	May impair coordination and may induce early symptoms in persons who have coronary, pulmonary or circulatory problems.
12% - 15%	Respiration and pulse increase; impaired coordination, perception and judgement occurs.
10% - 12%	Respiration further increases in rate and depth; poor judgement and bluish lips occur.
8% - 10%	Mental failure, fainting, unconsciousness, an ash-coloured face, blue lips, nausea and vomiting.
6% - 8%	8 minutes - 100% fatal; 4-5 minutes - recovery with treatment.
4% - 6%	Coma within 40 seconds, convulsions, respiration ceases - death

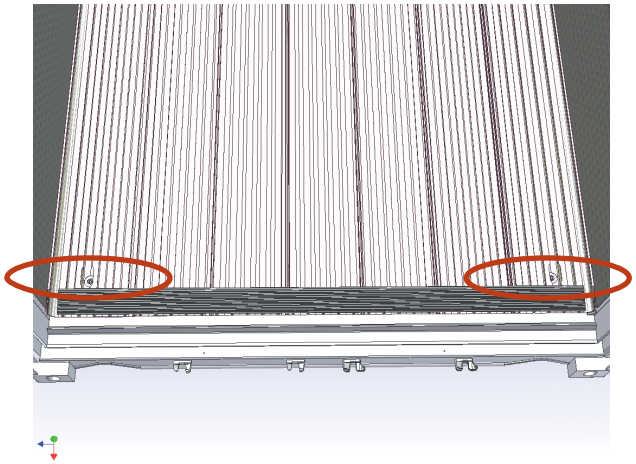
Pre Trip Inspection, PTI

Ensure the following manual inspection and function test is performed before taking the Star Cool CA unit into operations.
The progress of the pre trip test can be followed in the display T04 in steps.

Manual inspection

1. Check for structural damages on sides, doors and roof on the container.
2. Secure tight plugs at each of the floors drain plugs, placed near corners. Cut-out views from front end (left picture) and rear end (right picture)





3. Make sure service hatches are in perfect condition and installed correctly.
4. Inspect the fresh air module to ensure it is in perfect condition. Make sure the butterfly is operational and that the valves are intact.
5. Check drain hose for any damage.
6. Make sure lead-ins (cables and vacuum hose) are intact.
7. Check oil in the vacuum pump.

After ensuring steps 1-7 the unit is now ready for PTI.
Three types of pre trip inspections are available for the Star Cool CA unit: Full PTI, Short PTI and CA PTI. Please see Star Cool service manual for descriptions on Full PTI and Short PTI.

Function test

Two function tests are available for the Star Cool CA unit: STD and CA.
The CA function test has the following steps:
1. STD function test
2. CO2 sensor test
3. O2 sensor test
4. AirEx motor test

Operation

Set points:
CO2 and O2 set points are entered in the menu structure O07 an O08.
O2 levels below 2% can not be entered.
CO2 levels below 5% can not be entered.

Level readings:
O2 and CO2 concentrations can be viewed in the menu structure I03 and I04. The membrane pressure can be viewed in the menu structure I18 - this displays the vacuum level created. Vacuum pump oil temperature can be viewed in the menu structure I36.

Manual mode

The AirEx motor can be activated in manual mode in the menu structure M09.

0%: Valve closed
100%: Valve open

The vacuum pump can be activated in the menu structure M10. Activating the vacuum pump should result in a pressure drop which can be viewed in the menu structure I18.
Only manually activate the vacuum pump when absolutely necessary! The vacuum pump is not pre-heated if manually activated - this can cause damage to the vacuum pump over time.

CA curtain

When CA is activated a CA curtain must be installed. Ensure the CA curtain is installed in accordance with the guide included with the CA curtain.

Vacuum system test

Note: **BE AWARE OF HOT SURFACES** - when handling the vacuum pump.
The vacuum system consists of a membrane connected with a hose to a vacuum pump. Below you will find a step-by-step method to determine the root cause of a vacuum fault. Please be aware that there can be more than one problem in a vacuum system, and you might need to go through the tutorial several times to eliminate the problem.

A vacuum fault alarm can be caused by a single or a combination of the following:

1. Insufficient amount of oil in vacuum pump
2. Defective pressure transmitter
3. Defective or leakage in vacuum pump
4. Leak in fittings or connections
5. Leak in membrane

Method to determine the cause:

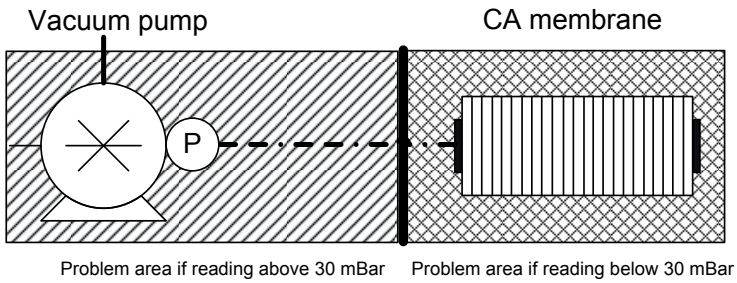
1. Check oil level in the vacuum pump. Refill if needed.
2. Go to menu structure M10 and turn on the vacuum pump and verify that it rotates in the right direction. If vacuum pump does not activate, see section
   "Simple trouble shooting vacuum pump / controller module" on page 12. If vacuum pump acti vates proceed to 3.
3. Disconnect the vacuum hose at the vacuum pump and plug the vacuum pump inlet.
   a. If the pressure is above 30 mBar, proceed to 4
   b. A pressure below 30 mBar indicates the vacuum pump is OK, proceed with the following:
      Connect the hose to the vacuum pump again and ensure the connection is tight.
4. Install a manometer at the transmitter inlet and ensure the reading is similar to the display reading. If not, the pressure transmitter is defect. If pressure is OK, change the vacuum pump. Go to menu structure M10 and turn on the vacuum pump.

   If the vacuum fault alarm is still present - 2 options from here:

   If unit is in operation with cargo: Do nothing! Either the membrane or the connection to the membrane is leaking. It is not possible to correct this fault during operation, due to low oxygen level inside container.

⚠ Do not enter the container - including opening the service hatches - when oxygen level is below 20.9%.

   Empty container: Disconnect the vacuum hose at the membrane and plug the hose.
   Go to menu structure M10 and turn on the vacuum pump.
   If readings are:
   - Above 30 mBar: "Problem surrounding the vacuum hose" on page 12
   - Below 30 mBar: "Problem located at membrane" on page 12



Problem surrounding the vacuum hose

In case of a defective vacuum hose:
1. Check hose for leaks. Repair or replace.
2. After repair or replacement of the vacuum hose, perform “Container leak test” on page 12

Problem located at membrane

1. Ensure vacuum hose is connected correctly.
2. If this does not solve the problem, replace membrane.

Please note that this step by step only resolves one leak in the system, and may need to be repeated until the leak is fully terminated. See “Container leak test” on page 12

Simple trouble shooting vacuum pump / controller module

1. Check contactor coil K9.
2. Measure wirering, see wire diagram.
3. Measure bi-metallic switch (optional component). If no connection, replace switch.
4. Pull contactor K9 manually. If pump starts, replace controller module
5. Pull contactor K9 manually. If pump does not start, replace the pump.

Container leak test

A container leak test needs to be performed when:
- After replacing vacuum hose
- After replacing wiring going through the unit
- After replacing hoses and or piping going through the unit
- After replacing or opening service hatch
- After repairing structural damage on the unit and or container
- After replacing fresh air valve and or module
- When a container is suspected of leakage

Equipment needed:
- Star Cool test damper
- Test manometer - differential pressure gauge (for instance a Dwyer Magnehelic model 2002)
- CA curtain
- Drain plugs

Method:
1. Install drain plugs
2. Install CA curtain according to instructions supplied along with the curtain
3. Install Star Cool test damper
4. Connect test manometer
5. Apply air pressure 500 Pa
6. Close air supply, and wait 12 min
7. Ensure pressure is min. 250 Pa after 12 min

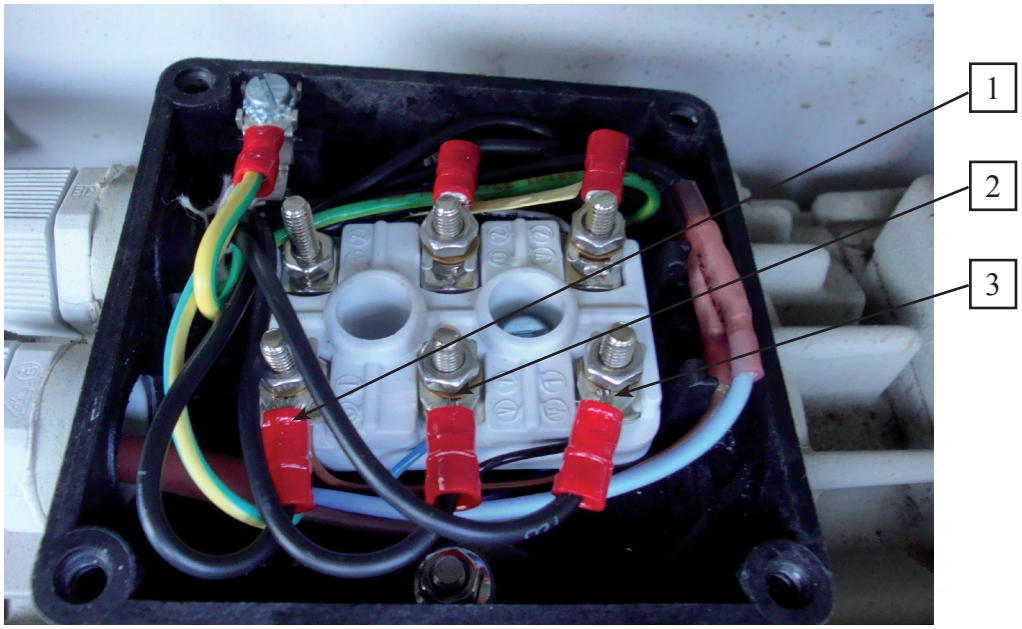
Test criteria:
Pressure drop: 2” water column to 1” water column (500 Pa to 250 Pa)
Min. test time: 720 sec (12 min)
If test fails, leak must be located, repaired and test performed over again.

Oil charge and drain

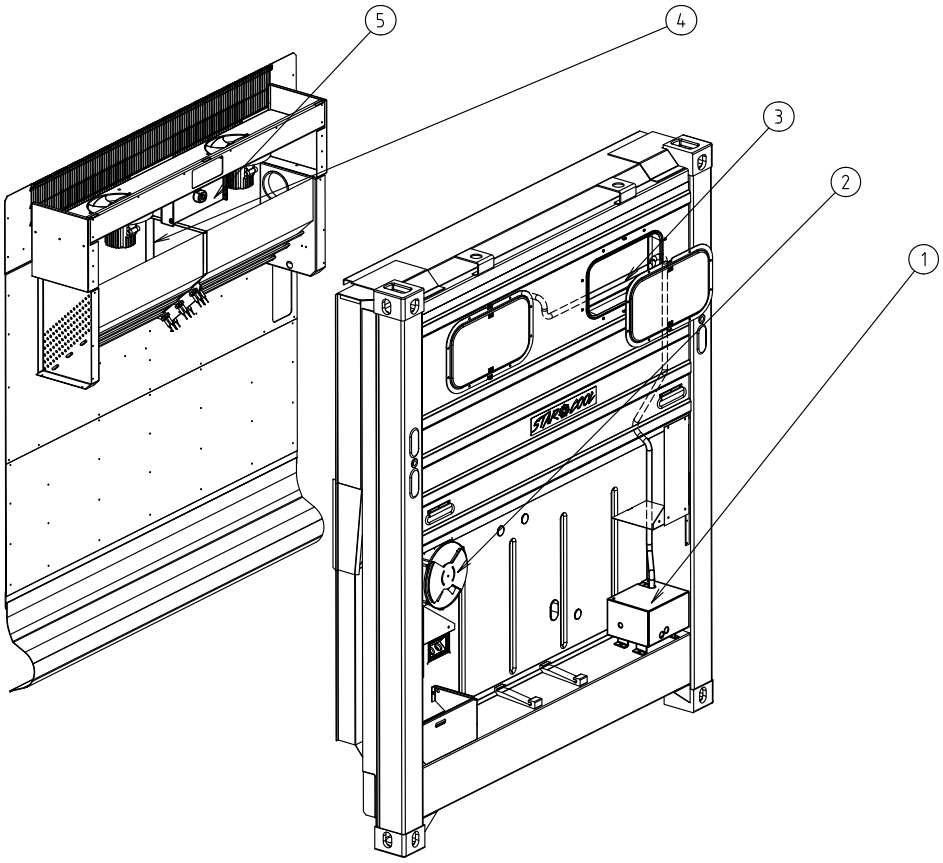
Oil filter should be replaced at every oil change.
1. **BE AWARE OFF HOT SURFACES**.
2. Remove cover shield from vacuum pump by the 4 bolts.
3. Remove the plug for oil charge, see Vacuum pump in “Components” on page 15.
4. Charge oil while watching the sight glass - do not overcharge.
5. Fasten plug immediately after oil charge.

Replacement of vacuum pump heating element

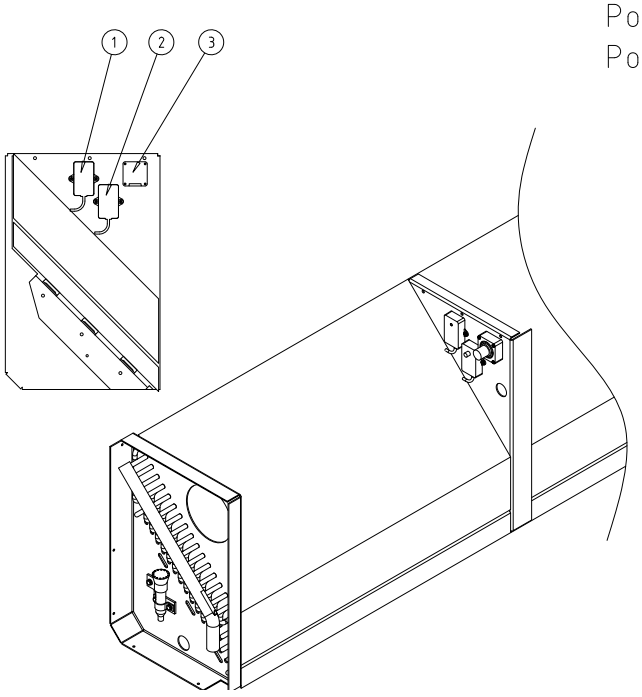
1. Turn power off!
2. **BE AWARE OFF HOT SURFACES**.
3. Remove cover shield from vacuum pump by the 4 bolts. Release vacuum pump from its socket
4. Unplug sensor cables from terminal box on top of the vacuum pump and tilt vacuum pump to avoid oil spill when replacing the heating element.
5. Attach cables to terminal box on top of the vacuum pump according to illustration below.
6. Turn on power.



Locations of components



Pos. 1: Vacuum pump
Pos. 2: Fresh air module
Pos. 3: Vacuum pump hose
Pos. 4: Sensor location (O2 and CO2)
Pos. 5: CA membrane module



Pos. 1: RH sensor
Pos. 2: O2 sensor
Pos. 3: CO2 sensor

Components

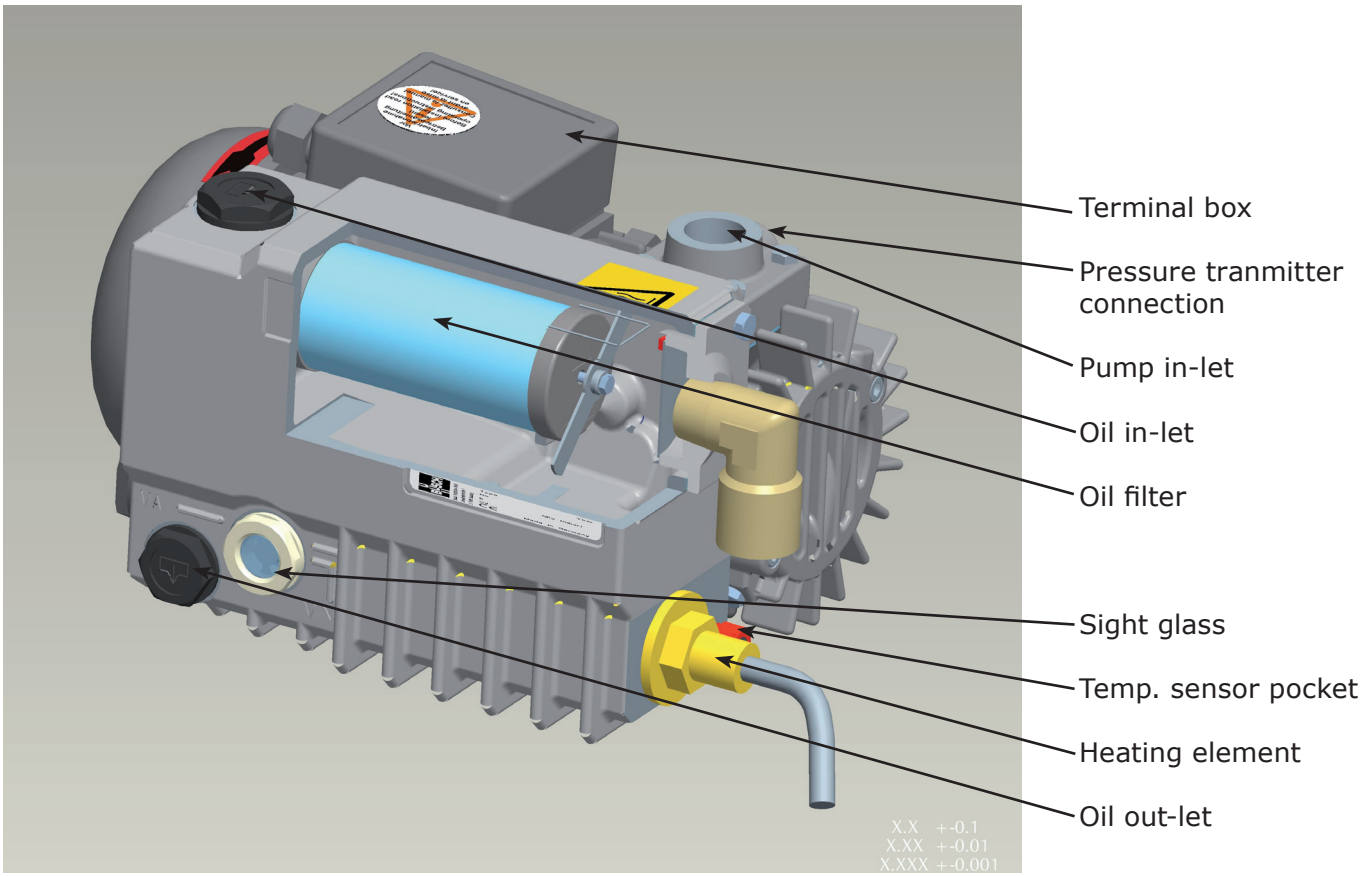
CA membrane module

Pressure transmitter

CO2 sensor	O2 sensor

Displayed sensors may vary from currently used models

Vacuum pump



Tightening torques for M6 screws at vacuum pump console: 6 Nm
Tightening torques for plugs and heating element: 15 Nm

CA related alarms
Alarm list:

Id	Display text	Description	Alarm type
1. Temperature sensor alarms			
130	Tpump open	Vacuum pump temperature sensor open circuit	Warning
131	Tpump short	Vacuum pump temperature sensor short circuit	Warning
132	Tpump invalid	Vacuum pump temperature sensor invalid	Warning
2. Pressure sensor alarms			
211	Pmem open	Vacuum pump pressure transmitter open circuit	Warning
212	Pmem short	Vacuum pump pressure transmitter short circuit	Warning
213	Pmem invalid	Vacuum pump pressure transmitter invalid	Warning
214	Pmem fault	Pressure system fault	Warning
3. Other sensor alarms			
310	CO2 invalid	CO2 sensor communication missing	Alarm
313	O2 invalid	O2 sensor communication missing	Alarm
4. Power alarms			
403	Mpump over heat	Vacuum pump motor overheat	Warning
6. Operations alarms			
650	O2 low	O2 sensor measures low O2 level in container	Alarm
651	CO2 high	CO2 sensor measures high CO2 level in container	Alarm
652	Vacuum fault	The pressure sensor measures high pressure in the vacuum system	Alarm

653	Mpump temp low	Vacuum pump operating temperature is low	Alarm
654	Mpump temp high	Motor for vacuum pump is overheated	Alarm
656	Mpump service	Vacuum pump needs oil change	Fatal alarm
657	Mpump wrong phase	Vacuum pump operating in wrong direction	Fatal alarm
7. Communication alarms			
740	CO2 sensor missing	CO2 sensor is missing or communication lost	Alarm
750	CA module missing	CA module is missing or communication lost	Alarm
760	O2 sensor missing	O2 sensor is missing or communication lost	Alarm
8. Test alarms			
826	Hpump current ON	Heat vacuum pump too high or too low	Alarm
827	Hpump current OFF	Current in off position is too high	Alarm
831	Pmem sensor	Pmem above or below 1000 mBar (+50/-50) after Mpump off for 300 sec	Alarm
832	CO2 sensor	No reading or value above 1%	Alarm
833	O2 sensor	No reading or value out of range	Alarm
834	Mair open	Readings for fresh air valve position is outside specified range	Alarm
835	Mair closed	Readings for fresh air valve position is outside specified range	Alarm
836	Pmem vacuum	Unable to create vacuum	Alarm
837	Pmem ambient	Not measuring Pmem pressure 1000 mBar (-50/+50 mBar)	Alarm
838	Mpump ON current	Current failure	Alarm
839	Mpump OFF current	Current in off position is too high	Alarm
890	PTI Tset-13	Unable to reach set point (13°C) (55°F) within 3 hours and staying in-range for 30 min	Alarm
9. Controller alarms			
977	Pmem sens sup LOW	Controller internal voltage reference fault	Warning
978	Pmem sens sup HIGH	Controller internal voltage reference fault	Warning
998	Could not detect CA	Unable to detect CA	Warning

Replacing the controller module

Failure scenario	Replacement action
SMC6 + SCC6-CA **Defective**	SSC6-CA **Or** SMC6.1 **Recommended**
SMC6 **Defective** + SSC6-CA	SMC6 **Or** SMC6.1 **Recommended**
SMC6 **Defective**	SMC6 **Or** SMC6.1 **Recommended**
SMC6.1 **Defective**	SMC6.1

Temperature sensor alarms (1XX)

<table>
<tr><th>130</th><th colspan="5">Tpump open</th><th>Warning</th></tr>
<tr><td>Description</td><td colspan="6">Vacuum pump temperature sensor open circuit</td></tr>
<tr><td>Cause</td><td colspan="6">Indication of loose connection, defective temperature sensor</td></tr>
<tr><td>Trouble shooting</td><td colspan="6">Possible causes:
• Temperature sensor Tpump or its cable is defective
• Controller module is defective
Accompanied alarms:
• AL 132
Trouble shooting:
1. Disconnect the sensor cable for sensor Tpump from the connector on the controller module, according to the wiring schematics inside in the control cabinet
2. Measure the resistance between the two wires
a) If this resistance is more than 1.5 MΩ, the cable or the sensor is defect, replace sensor
b) If this resistance matches the resistance and temperature in Tables (Star Cool manual), the temperature sensor and cable are OK
3. Measure the voltage over the connector for Tpump. It should be between 3.2 and 3.4 V DC
a) If the voltage is within the specified range, connect sensor again. Measure the voltage over the sensor and check voltage/ temperature according to Tables (Star Cool manual)
b) If the voltage is outside the above range, the controller module, is defect or other sensors may be defect and pulling the voltage down. Check other alarms and see Trouble shooting for Star Cool Main Controller (Star Cool manual) before replacing controller door</td></tr>
<tr><td>Criteria</td><td colspan="6">Value below low alarm limit -35°C (-31°F)</td></tr>
<tr><td rowspan="2">Controller action</td><td colspan="6">None</td></tr>
<tr><td>Log</td><td>X</td><td>Alarm</td><td>X</td><td>Alarm light</td><td>Off</td></tr>
<tr><td>Consequence</td><td colspan="6">It is not possible to control the heating element in the vacuum pump</td></tr>
<tr><td>Elimination</td><td colspan="6">When sensor value becomes valid, it is marked as inactive in the alarm list and may then be deleted</td></tr>
<tr><td rowspan="2">Log data</td><td>Parm 1</td><td>Parm 2</td><td>Parm 3</td><td>Parm 4</td><td colspan="2">Parm 5</td></tr>
<tr><td>Active/Inactive</td><td>Low limit</td><td>High limit</td><td>Current</td><td colspan="2"></td></tr>
</table>

<table>
<tr><th>131</th><th colspan="5">Tpump short</th><th>Warning</th></tr>
<tr><td>Description</td><td colspan="6">Vacuum pump temperature sensor short circuit</td></tr>
<tr><td>Cause</td><td colspan="6">Indication of short-circuited temperature sensor</td></tr>
<tr><td>Trouble shooting</td><td colspan="6">Possible causes:
• Temperature sensor Tpump or its cable defective
• Controller module defective
Accompanied alarms:
• AL 132
Trouble shooting:
1. Disconnect the sensor cable for sensor Tpump from the connector on the controller module, according to the wiring schematics inside in the control cabinet.
2. Measure the resistance between the two wires.
a) If the resistance is less than (<) 230 Ω, the cable or the sensor is defect, replace sensor
b) If the resistance matches the resistance and temperature in Tables (Star Cool Manual), the temperature sensor and cable are OK.
3. Measure the voltage over the connector for Tpump, it should be between 3.2 and 3.4 V DC.
a) If the voltage is inside the above range, connect sensor again. Measure the voltage over the sensor and check voltage/ temperature according to Tables (Star Cool Manual).
b) If the voltage is outside the above range, the controller module is defect or other sensors may be defect and pulling the voltage down.
Check other alarms and see Trouble shooting for Star Cool Main Controller (Star Cool Manual) before replacing controller door.</td></tr>
<tr><td>Criteria</td><td colspan="6">Value above high alarm limit +140°C (+284°F).</td></tr>
<tr><td rowspan="2">Controller action</td><td colspan="6">None</td></tr>
<tr><td>Log</td><td>X</td><td>Alarm</td><td>X</td><td>Alarm light</td><td>Off</td></tr>
<tr><td>Consequence</td><td colspan="6">It is not possible to control the heating element in the vacuum pump</td></tr>
<tr><td>Elimination</td><td colspan="6">When sensor value becomes valid, it is marked as inactive in the alarm list and may then be deleted</td></tr>
<tr><td rowspan="2">Log data</td><td>Parm 1</td><td>Parm 2</td><td>Parm 3</td><td>Parm 4</td><td colspan="2">Parm 5</td></tr>
<tr><td>Active/Inactive</td><td>Low limit</td><td>High limit</td><td>Current</td><td colspan="2"></td></tr>
</table>

<table>
<tr><th>132</th><th colspan="5">Tpump invalid</th><th>Warning</th></tr>
<tr><td>Description</td><td colspan="6">Vacuum pump temperature sensor invalid</td></tr>
<tr><td>Cause</td><td colspan="6">Indication of defective temperature sensor or its measuring circuitry</td></tr>
<tr><td>Trouble shooting</td><td colspan="6">Possible causes:
• Active alarms AL 130 or AL 131
• Temperature sensor reading is out of valid range:
-35°C (-31°F) or above +130°C (266°F)
Accompanied alarms:
• AL 130 or AL 131 may also be active.
Trouble shooting:
1. Check accompanied alarms
2. Disconnect the sensor cable for sensor Tpump from the connector on the controller module, according to the wiring schematics inside in the control cabinet.
3. Measure the resistance between the two wires.
a) If the resistance is out of range of the resistance and temperature table in Tables (Star Cool Manual), the temperature sensor and cable are defect and should be replaced.
b) If the resistance is within range, perform controller door check Trouble shooting for Star Cool Main Controller (Star Cool Manual) before replacing controller door.</td></tr>
<tr><td>Criteria</td><td colspan="6">Reading below -35°C (-31°F) or above +130°C (266°F)</td></tr>
<tr><td rowspan="2">Controller action</td><td colspan="6">None</td></tr>
<tr><td>Log</td><td>X</td><td>Alarm</td><td>X</td><td>Alarm light</td><td>Off</td></tr>
<tr><td>Consequence</td><td colspan="6">It is not possible to control the heating element in the vacuum pump</td></tr>
<tr><td>Elimination</td><td colspan="6">When sensor value becomes valid, it is marked as inactive in the alarm list and may then be deleted. Value must be valid for 60 sec. to set alarm inactive.</td></tr>
<tr><td rowspan="2">Log data</td><td>Parm 1</td><td>Parm 2</td><td>Parm 3</td><td>Parm 4</td><td colspan="2">Parm 5</td></tr>
<tr><td>Active/Inactive</td><td></td><td></td><td></td><td colspan="2"></td></tr>
</table>

Pressure sensor alarms (2XX)

211	Pmem open				Warning
Description	Vacuum pump pressure transmitter open circuit				
Cause	Indication of loose connection, defective or lack of vacuum pump pressure transmitter				
Trouble shooting	Possible causes: • See AL 212 Accompanied alarms: • AL 213 Trouble shooting: 1. Check that the connector is mounted correctly according to wiring schematic. a) Check the cable (measure the resistance in the cable). If the cable is defective, replace cable. b) Disconnect signal wire on controller module according to wiring schematic. Measure voltage between dissconnected signal wire and GND on controller module. If voltage is above 4.7 V DC, transmitter or connection between transmitter and cable is defective. If not, then mount signal wire. Measure voltage between SIGNAL and GND. If voltage is between 0.2 V DC and 4.7 V DC and this alarm is still active, then replace controller module.				
Criteria	Pmem > 1150 mBar				
Controller action	None				
	Log	X	Alarm	X	Alarm light	Off
Consequence	No consequence as to control				
Elimination	When transmitter value becomes valid, it is marked as inactive in the alarm list and may then be deleted.				
Log data	Parm 1	Parm 2	Parm 3	Parm 4	Parm 5
	Active/Inactive	Low limit	High limit	Present	

<table>
<tr><th>212</th><th colspan="5">Pmem short</th><th>Warning</th></tr>
<tr><td>Description</td><td colspan="6">Vacuum pump pressure transmitter short circuit</td></tr>
<tr><td>Cause</td><td colspan="6">Indication of short-circuited vacuum pump pressure transmitter</td></tr>
<tr><td>Trouble shooting</td><td colspan="6">Possible causes:
• Connector for pressure transmitter Pmem not correctly mounted
• Vacuum pump pressure transmitter Pmem defective
• Cable for vacuum pump pressure transmitter Pmem defective
• Controller module defective
Accompanied alarms:
• AL 213
Trouble shooting:
1. Check that the connector is mounted correctly according to wiring schematic.
a) Check the cable (measure the resistance in the cable).
If the cable is defective, replace cable.
b) Disconnect signal wire on controller module according to wiring schematic.
Measure voltage between dissconnected signal wire and GND on controller module.
If voltage is below 0.2 V DC, transmitter or connection between transmitter and cable is defective.
If not, then mount signal wire. Measure voltage between SIGNAL and GND.
If voltage is between 0.2 V DC and 4.7 V DC and this alarm is still active, then replace controller module.</td></tr>
<tr><td>Criteria</td><td colspan="6">Pmem < 10 mBar</td></tr>
<tr><td rowspan="2">Controller action</td><td colspan="6">None</td></tr>
<tr><td>Log</td><td>X</td><td>Alarm</td><td>X</td><td>Alarm light</td><td>Off</td></tr>
<tr><td>Consequence</td><td colspan="6">None</td></tr>
<tr><td>Elimination</td><td colspan="6">When transmitter value becomes valid, it is marked as inactive in alarm list and may then be deleted</td></tr>
<tr><td rowspan="2">Log data</td><td>Parm 1</td><td>Parm 2</td><td>Parm 3</td><td>Parm 4</td><td colspan="2">Parm 5</td></tr>
<tr><td>Active/Inactive</td><td>Low limit</td><td>High limit</td><td>Present</td><td colspan="2"></td></tr>
</table>

<table>
<tr><th>213</th><th colspan="5">Pmem invalid</th><th>Warning</th></tr>
<tr><td>Description</td><td colspan="6">Vacuum pump pressure transmitter invalid</td></tr>
<tr><td>Cause</td><td colspan="6">Indication of defective Vacuum pump pressure Transmitter or its measuring circuitry</td></tr>
<tr><td>Trouble shooting</td><td colspan="6">Possible causes:
• See AL 212
Accompanied alarms:
• AL 211 or AL 212 may also be active
Trouble shooting:
1. Check that the connector is mounted correctly according to the drawing.
a) Check the cable (measure the resistance in the cable).
If the cable is defective, replace cable.
b) Disconnect signal wire on controller module according to wiring schematic.
Measure voltage between signal wire and GND on controller module according to wiring schematic.
If voltage is below 0.2 V DC, transmitter or connection between transmitter and cable is defective.
If not, then mount signal wire. Measure voltage between SIGNAL and GND
If voltage is between 0.2 V DC and 4.7 V DC and this alarm is still active, then replace controller module.</td></tr>
<tr><td>Criteria</td><td colspan="6">Pmem out of range for more than 30 sec</td></tr>
<tr><td rowspan="2">Controller action</td><td colspan="6">Replacement by new value from AAS system</td></tr>
<tr><td>Log</td><td>X</td><td>Alarm</td><td>X</td><td>Alarm light</td><td>Off</td></tr>
<tr><td>Consequence</td><td colspan="6">None</td></tr>
<tr><td>Elimination</td><td colspan="6">When transmitter value becomes valid, it becomes marked as inactive in alarm list may then be detected. Value must be valid for 60 sec. to set alarm inactive.</td></tr>
<tr><td rowspan="2">Log data</td><td>Parm 1</td><td>Parm 2</td><td>Parm 3</td><td>Parm 4</td><td colspan="2">Parm 5</td></tr>
<tr><td>Active/Inactive</td><td></td><td></td><td></td><td colspan="2"></td></tr>
</table>

214	Pmem fault				Warning
Description	Pressure system fault				
Cause	Pressure <10 mBar or >1150 mBar				
Trouble shooting	Possible causes: • See AL 212 Accompanied alarms: • AL 213 may be active Trouble shooting: 1. See AL 212				
Criteria	10 mBar or > Pmem > 1150 mBar				
Controller action	None				
	Log	X	Alarm	X	Alarm light	Off
Consequence	None				
Elimination	When sensor value becomes valid, it is marked as inactive in the alarm list and may then be deleted				
Log data	Parm 1	Parm 2	Parm 3	Parm 4	Parm 5
	Active/Inactive	Low limit	High limit	Act	0

Other sensor alarms (3XX)

<table>
<tr><th>310</th><th colspan="5">CO2 invalid</th><th>Alarm</th></tr>
<tr><td>Description</td><td colspan="6">CO2 sensor communication missing</td></tr>
<tr><td>Cause</td><td colspan="6">Indication of defective CO2 sensor, or lack of or improper connection</td></tr>
<tr><td>Trouble shooting</td><td colspan="6">Possible causes:
• Communication with CO2 sensor
• Defective CO2 sensor
• COMRH cable, RH-cable and or COMCA cable is defective
• Controller module is defective
Accompanied alarms:
• AL 740
Trouble shooting:
1. Verify that cable CO2-com is mounted correctly (and is not damaged) according to wiring diagram inside the controller cabinet.
2. Verify that there are correct voltages 12 V DC between 1 and 4 on X10.
3. Measure with a multimeter that there is a small DC signal between 2 and 3 on X10.
a) If there is signal: The CO2 sensor is defective and must be replaced.
b) If there is no signal: The controller module is defective and must be replaced.</td></tr>
<tr><td>Criteria</td><td colspan="6">Communication with CO2 sensor not possible</td></tr>
<tr><td rowspan="2">Controller action</td><td colspan="6">Run pump 40%</td></tr>
<tr><td>Log</td><td>X</td><td>Alarm</td><td>X</td><td>Alarm light</td><td>Slow flash</td></tr>
<tr><td>Consequence</td><td colspan="6">CO2 level can not be regulated</td></tr>
<tr><td>Elimination</td><td colspan="6">When sensor value becomes valid, it is marked as inactive in the alarm list and may then be deleted</td></tr>
<tr><td rowspan="2">Log data</td><td>Parm 1</td><td>Parm 2</td><td>Parm 3</td><td>Parm 4</td><td colspan="2">Parm 5</td></tr>
<tr><td>Active/Inactive</td><td></td><td></td><td></td><td colspan="2"></td></tr>
</table>

<table>
<tr><th>313</th><th colspan="5">O2 invalid</th><th>Alarm</th></tr>
<tr><td>Description</td><td colspan="6">O2 sensor communication missing</td></tr>
<tr><td>Cause</td><td colspan="6">Indication of defective O2 sensor, or lack of or improper connection</td></tr>
<tr><td>Trouble shooting</td><td colspan="6">Possible causes:
• Communication with O2 sensor
• COMRH cable, RH-cable and or COMCA cable is defective
• Defective O2 sensor
• Controller module is defective
Accompanied alarms:
• AL 310, AL 302 and or AL 760, (See service manual).
Trouble shooting:
1. Verify that cable O2-com is mounted correctly (and is not damaged) according to wiring diagram inside the controller cabinet.
2. Verify that plugs are properly connected.
3. Verify that there are correct voltages 12 V DC between 1 and 4 on X10.
a) If there is signal: The O2 sensor is defective and must be replaced.
b) If there is no signal: The controller module is defective and must be replaced.</td></tr>
<tr><td>Criteria</td><td colspan="6">Communication with O2 sensor not possible</td></tr>
<tr><td rowspan="2">Controller action</td><td colspan="6">Open airex 4%</td></tr>
<tr><td>Log</td><td>X</td><td>Alarm</td><td>X</td><td>Alarm light</td><td>Slow flash</td></tr>
<tr><td>Consequence</td><td colspan="6">O2 level can not be regulated</td></tr>
<tr><td>Elimination</td><td colspan="6">When sensor value becomes valid, it is marked as inactive in the alarm list and may then be deleted</td></tr>
<tr><td rowspan="2">Log data</td><td>Parm 1</td><td>Parm 2</td><td>Parm 3</td><td>Parm 4</td><td colspan="2">Parm 5</td></tr>
<tr><td>Active/Inactive</td><td></td><td></td><td></td><td colspan="2"></td></tr>
</table>

Power alarms (4XX)

403	Mpump over heat				Warning
Description	Vacuum pump motor overheat				
Cause	Indication of an overheated motor or a loose thermistor cable connection				
Trouble shooting	Possible causes: • Vacuum pump motor defective. • Cable for measuring vacuum pump motor overheat defect. • Controller module defective. Accompanied alarms: • N/A. Trouble shooting: 1. Turn off unit! Take of the fan cover for the vacuum pump, see if the fan can easily turn freely by finger. If not, perform oil check. See trouble shooting AL 656. If the motor is hot, it may be overloaded and jammed or defect. 2. If the cable for MpumpOH by inspection is defect, replace cable. 3. Disconnect the cable for MpumpOH from the controller module according to the wiring schematics. 4. Measure the resistance in the cable. If the resistance is more than 1 MΩ, the cable or the motor is defect and should be replaced. If the resistance is less than (<) 5 kΩ, the cable and motor should be OK. 5. Turn unit on again. Measure the voltage over the connector for MpumpOH. It should be between 4.80 V DC and 5.05 V DC. a) If the voltage is inside the above range, connect sensor again. Measure the voltage over the sensor and check the voltage. If the voltage is less than (<) 2.5 V DC, the measurement is OK. If the alarm after 30 sec. is still active on the display, the controller module is defect - replace controller module. b) If the voltage is outside the range, controller module is defect or another error might affect the voltage. Check other alarms before replacing controller module.				
Criteria	Value above high alarm limit 10k Ohm				
Controller action	Vacuum pump is stopped until alarm is removed				
	Log	X	Alarm	X	Alarm light	Off
Consequence	Extraction of CO2 is stopped				
Elimination	When overheating stops, alarm will be marked as inactive in alarm list and may then be deleted				
Log data	Parm 1	Parm 2	Parm 3	Parm 4	Parm 5
	Active/Inactive		High limit	Present	

Operation alarms (6XX)

650	O2 low					Alarm
Description	O2 sensor measures low O2 level in container					
Cause	The system is not able to vent fresh air into the container					
Trouble shooting	Possible causes: • Lack of oil in the vacuum pump • Automatic Fresh air defect • O2 sensor defect Trouble shooting: 1. See if automatic Air Exchange valves are open. If not, try to open in manual mode 2. See if vacuum pump is running. a) If the pump is running it will in time make sure there is enough O2 in the box. Open the damper to accelerate this, open it until O2 level is higher than O2 set point.					
Criteria	O2 level < O2 set point – 0.3 * O2 set point					
Controller action	Run pump 40%					
	Log	X	Alarm	X	Alarm light	X
Consequence	If not flushed with O2 cargo might experience anaerobic respiration and thereby deteriorate					
Elimination	When sensor value becomes valid, it is marked as inactive in the alarm list and may then be deleted					
Log data	Parm 1	Parm 2	Parm 3	Parm 4	Parm 5	
		Limit	Act	Set point		

<table>
<tr><th>651</th><th colspan="5">CO2 high</th><th>Alarm</th></tr>
<tr><td>Description</td><td colspan="6">CO2 sensor measures high CO2 level in container</td></tr>
<tr><td>Cause</td><td colspan="6">The system is not able to extract the CO2 through the membrane</td></tr>
<tr><td>Trouble shooting</td><td colspan="6">Possible causes:
• Lack of oil in the vacuum pump
• Vacuum pump is not running or defective
• Membrane is defective
• CO2 sensor defective

Trouble shooting:
1. The vacuum pump is not running.
a) Check if the bi-metallic switch is connected according to the wire schematic X78 (depending on model).
b) Push the contactor in the control cabinet, if the pump is then activated replace controller module. If the pump is not running when pushing the contactor, replace vacuum pump.
2. The vacuum pump is running.
a) Check oil level in vacuum pump.
b) Read out the pump pressure I18 if > 200 mbar the vacuum system has a leak. Check entire system for air leaks. If no air leaks is found the pump might be defect. See ”Vacuum system test” on page 11
b) Read out the pump pressure I18 if < 200 mBar the membrane is defect. Replace membrane.</td></tr>
<tr><td>Criteria</td><td colspan="6">CO2 level > CO2 set point + 0.5 * CO2 set point (and rising)</td></tr>
<tr><td rowspan="2">Controller action</td><td colspan="6">Run pump 100%</td></tr>
<tr><td>Log</td><td>X</td><td>Alarm</td><td>X</td><td>Alarm light</td><td>X</td></tr>
<tr><td>Consequence</td><td colspan="6">If not CO2 is removed from the container, this will cause damage to the cargo</td></tr>
<tr><td>Elimination</td><td colspan="6">When sensor value becomes valid, it is marked as inactive in the alarm list and may then be deleted</td></tr>
<tr><td rowspan="2">Log data</td><td>Parm 1</td><td>Parm 2</td><td>Parm 3</td><td>Parm 4</td><td colspan="2">Parm 5</td></tr>
<tr><td></td><td>Limit</td><td>Act</td><td>Set point</td><td colspan="2"></td></tr>
</table>

<table>
<tr><th>652</th><th colspan="5">Vacuum fault</th><th>Alarm</th></tr>
<tr><td>Description</td><td colspan="6">Vacuum pump unable to reach required pressure</td></tr>
<tr><td>Cause</td><td colspan="6">The vacuum system might have a leak or the pressure sensor is defect</td></tr>
<tr><td>Trouble shooting</td><td colspan="6">Possible causes:
• Lack of oil
• Leak in vacuum system or membrane
• Defective pressure sensor
• Vacuum pump is defective
Accompanied alarms:
• AL 403
Trouble shooting:
1. If AL 403 is active, see trouble shooting for AL 403. If AL 652 does not turn inactive, proceed with 2.
2. The vacuum pump is not running.
a) Check if the bi-metallic switch is connected according to the wire schematic X78 (depending on model)
b) Pushing the contactor in the control cabinet, if the pump is then activated replace controller module. If the pump is not running when pushing the contactor, check contactor and vacuum pump.
3. The vacuum pump is running.
a) Perform “Vacuum system test” on page 11</td></tr>
<tr><td>Criteria</td><td colspan="6">Pump on > 5 min AND Pmem > 135 mBar in 15 min, and CO2act > CO2set + 2%</td></tr>
<tr><td rowspan="2">Controller action</td><td colspan="6">None</td></tr>
<tr><td>Log</td><td>X</td><td>Alarm</td><td>X</td><td>Alarm light</td><td>X</td></tr>
<tr><td>Consequence</td><td colspan="6">If the system can not achieve low pressure, the membrane does not work and therefore not able to extract CO2 from the container</td></tr>
<tr><td>Elimination</td><td colspan="6">When sensor value becomes valid, it is marked as inactive in the alarm list and may then be deleted</td></tr>
<tr><td rowspan="2">Log data</td><td>Parm 1</td><td>Parm 2</td><td>Parm 3</td><td>Parm 4</td><td colspan="2">Parm 5</td></tr>
<tr><td></td><td>Limit</td><td>Act</td><td>Pump on time</td><td colspan="2"></td></tr>
</table>

<table>
<tr><th>653</th><th colspan="5">Mpump heat element</th><th>Alarm</th></tr>
<tr><td>Description</td><td colspan="6">Vacuum pump operating temperature is low</td></tr>
<tr><td>Cause</td><td colspan="6">The ambient temperature can be low and thereby difficult for the heating element and vacuum pump to heat up. It could also be a defective heating element</td></tr>
<tr><td>Trouble shooting</td><td colspan="6">Possible causes:
• Defective temperature sensor Tpump
• Defective heating element
• Defective contactor K9
Trouble shooting:
1. Check contactor
2. Ensure that Tpump is correctly mounted and inserted completely in the sensor pocket.
3. Defective heating element.
a) At the contactor measure the heating element, there should be approx 0.9 kΩ. If not replace heating element.</td></tr>
<tr><td>Criteria</td><td colspan="6">Heating pump on for 50 minutes; Tpump < Tamb + 5°C</td></tr>
<tr><td rowspan="2">Controller action</td><td colspan="6">None</td></tr>
<tr><td>Log</td><td>X</td><td>Alarm</td><td>X</td><td>Alarm light</td><td>X</td></tr>
<tr><td>Consequence</td><td colspan="6">Condensation of water vapor in the pump housing</td></tr>
<tr><td>Elimination</td><td colspan="6">When sensor value becomes valid, it is marked as inactive in the alarm list and may then be deleted</td></tr>
<tr><td rowspan="2">Log data</td><td>Parm 1</td><td>Parm 2</td><td>Parm 3</td><td>Parm 4</td><td colspan="2">Parm 5</td></tr>
<tr><td></td><td>Limit</td><td>Act</td><td>Pump on time</td><td colspan="2"></td></tr>
</table>

<table>
<tr><th>654</th><th colspan="5">Mpump temp high</th><th>Alarm</th></tr>
<tr><td>Description</td><td colspan="6">Motor for vacuum pump is overheated</td></tr>
<tr><td>Cause</td><td colspan="6">Indication of an overheated motor, this can be caused by very high ambient temperature or a defective pump</td></tr>
<tr><td>Trouble shooting</td><td colspan="6">Possible causes:
• Vacuum pump motor is overheated
• Vacuum pump is defective or jammed
Accompanied alarms:
• N/A
Trouble shooting:
1. Check if the fan for the vacuum pump can turn freely. If it cannot turn, remove any obstacle
2. Check that the vacuum housing is not blocked.
3. Check that the oil level in the pump is correct.
4. Check that heating element is turned off, and check heater contactor.
5. Check that the temperature sensor Tpump is installed correctly.
6. If none of the above solves the problem, and the pump seems to be more than 115°C (239°F) - replace vacuum pump.</td></tr>
<tr><td>Criteria</td><td colspan="6">Tpump > 115°C (239°F)</td></tr>
<tr><td rowspan="2">Controller action</td><td colspan="6">Stop vacuum pump</td></tr>
<tr><td>Log</td><td>X</td><td>Alarm</td><td>X</td><td>Alarm light</td><td>Off</td></tr>
<tr><td>Consequence</td><td colspan="6">The CA system will not be able to remove CO2 from the container</td></tr>
<tr><td>Elimination</td><td colspan="6">AL 654 will become invalid when temperature decreases</td></tr>
<tr><td rowspan="2">Log data</td><td>Parm 1</td><td>Parm 2</td><td>Parm 3</td><td>Parm 4</td><td colspan="2">Parm 5</td></tr>
<tr><td>Active/Inactive</td><td>High limit</td><td>Act</td><td></td><td colspan="2"></td></tr>
</table>

<table>
<tr><th>656</th><th colspan="5">Mpump service</th><th>Fatal alarm</th></tr>
<tr><td>Description</td><td colspan="6">Vacuum pump needs oil change</td></tr>
<tr><td>Cause</td><td colspan="6">Pump runtime > 2000 h</td></tr>
<tr><td>Trouble shooting</td><td colspan="6">Possible causes:
• Pump runtime > 2000 h
Accompanied alarms:
• None
Trouble shooting:
1. Replace vacuum pump oil and filter. Filling 0.35 L.
2. Run vacuum pump in 6 min. (manually).
3. Check if oil is clean - if not, replace oil again and go to 2).
4. When oil is still clean after running in 6 minutes, press the alarm for 10 sec, then the alarm will become inactive.
5. Press again to delete service alarm.</td></tr>
<tr><td>Criteria</td><td colspan="6">Pump runtime > 2000 h</td></tr>
<tr><td rowspan="2">Controller action</td><td colspan="6">None</td></tr>
<tr><td>Log</td><td>X</td><td>Alarm</td><td>X</td><td>Alarm light</td><td>Quick</td></tr>
<tr><td>Consequence</td><td colspan="6">Unit can not pass PTI.
Not performing oil-change every 2000 pump hours will decrease pump-lifetime dramatically</td></tr>
<tr><td>Elimination</td><td colspan="6">When alarm becomes inactive, it can be deleted</td></tr>
<tr><td rowspan="2">Log data</td><td>Parm 1</td><td>Parm 2</td><td>Parm 3</td><td>Parm 4</td><td colspan="2">Parm 5</td></tr>
<tr><td></td><td>Limit</td><td>Act</td><td></td><td colspan="2"></td></tr>
</table>

<table>
<tr><th>657</th><th colspan="5">Mpump wrong phase</th><th>Fatal alarm</th></tr>
<tr><td>Description</td><td colspan="6">Vacuum pump operating in wrong direction</td></tr>
<tr><td>Cause</td><td colspan="6">Pump ON > 7 sec and Pmem > 600 mBar</td></tr>
<tr><td>Trouble shooting</td><td colspan="6">Possible causes:
• Wrong phase direction
• Pressure tansmitter defective
• Vacuum hose leak
• Leaks in the vacuum system
• Contactor defective
• Supply voltage to pump defective
Accompanied alarms:
• AL 213, AL 214 and AL 998
Trouble shooting:
1. Check contactor K10
2. Check pump connection according to wire schematic
3. See “Vacuum system test” on page 11
4. Check pressure transmitter Pmem</td></tr>
<tr><td>Criteria</td><td colspan="6">Pump ON > 7 sec and Pmem > 600 mBar</td></tr>
<tr><td rowspan="2">Controller action</td><td colspan="6">None</td></tr>
<tr><td>Log</td><td>X</td><td>Alarm</td><td>X</td><td>Alarm light</td><td>Quick</td></tr>
<tr><td>Consequence</td><td colspan="6">Vacuum pump stop and CA non functionable</td></tr>
<tr><td>Elimination</td><td colspan="6">When alarm becomes inactive, it can be deleted</td></tr>
<tr><td rowspan="2">Log data</td><td>Parm 1</td><td>Parm 2</td><td>Parm 3</td><td>Parm 4</td><td colspan="2">Parm 5</td></tr>
<tr><td></td><td>Limit</td><td>Act</td><td>Pump on time</td><td colspan="2">CO2</td></tr>
</table>

Communication alarms (7XX)

<table>
<tr><th>740</th><th colspan="5">CO2 sensor missing</th><th>Alarm</th></tr>
<tr><td>Description</td><td colspan="6">CO2 sensor is missing or communication lost</td></tr>
<tr><td>Cause</td><td colspan="6">None or bad communication with CO2 sensor</td></tr>
<tr><td>Trouble shooting</td><td colspan="6">Possible causes:
• Communication to CO2 sensor lost
• CO2 sensor missing
• CO2 sensor defect
• COMRH cable, RH-cable and or COMCA are defective
• Main controller defective
Accompanied alarms:
• AL 302, AL 730, AL 750, AL 751 and AL 760 may accompany this alarm
Trouble shooting:
1. Verify that cable CO2-com is mounted correctly (and is not damaged) according to wiring diagram inside the controller cabinet.
2. Verify that there are correct voltages 12 V DC between 1 and 4 on X10.
3. Measure with a multimeter that there is a small DC signal between 2 and 3 on X10.
a) If there is signal: The CO2 sensor is defective and must be replaced.
b) If there is no signal: The controller module is defective and must be replaced.</td></tr>
<tr><td>Criteria</td><td colspan="6">No communication for 2 min.</td></tr>
<tr><td rowspan="2">Controller action</td><td colspan="6">None</td></tr>
<tr><td>Log</td><td>X</td><td>Alarm</td><td>X</td><td>Alarm light</td><td>X</td></tr>
<tr><td>Consequence</td><td colspan="6">Not possible to run CA</td></tr>
<tr><td>Elimination</td><td colspan="6">Alarm may be deleted when inactive</td></tr>
<tr><td rowspan="2">Log data</td><td>Parm 1</td><td>Parm 2</td><td>Parm 3</td><td>Parm 4</td><td colspan="2">Parm 5</td></tr>
<tr><td></td><td>0</td><td>0</td><td>0</td><td colspan="2">Err code</td></tr>
</table>

750	CA module missing				Alarm
Description	CA module is missing or communication is missing				
Cause	CA module sensor is missing or communication lost				
Trouble shooting	Possible causes: • CA module missing • Communication to CA module lost • CA module defective Accompanied alarms: • AL 302, AL 730, AL 740 and AL 760 may accompany this alarm Trouble shooting: 1. If one or more alarms are active, check wires, plugs and connectors. 2. Check voltage supply according to wire schematic. 3. If only AL 750 active, then check connection to CA module and correct if faulty. If no change, then replace CA module.				
Criteria	No communication for 2 min.				
Controller action	None				
	Log	X	Alarm	X	Alarm light	X
Consequence	Not possible to run CA				
Elimination					
Log data	Parm 1	Parm 2	Parm 3	Parm 4	Parm 5
		0	0	0	Err code

<table>
<tr><th>760</th><th colspan="5">O2 sensor missing</th><th>Alarm</th></tr>
<tr><td>Description</td><td colspan="6">O2 sensor is missing or communication lost</td></tr>
<tr><td>Cause</td><td colspan="6">None or faulty communication with O2 sensor</td></tr>
<tr><td>Trouble shooting</td><td colspan="6">Possible causes:
• Communication to O2 sensor missing
• Defective O2 sensor
• COMRH cable, RH-cable and or COMCA cable is defective
• Controller module defective
Accompanied alarms:
• AL 313, AL 730 and AL 740 may also be active
Trouble shooting:
1. If one or more alarms are active, check wires, plugs and connectors.
2. Check voltage according to wire diagram.
3. If only AL 760 active, then check connection to O2 sensor and correct if faulty. If no change, then replace CA module.</td></tr>
<tr><td>Criteria</td><td colspan="6">No communication for 2 min.</td></tr>
<tr><td rowspan="2">Controller action</td><td colspan="6">None</td></tr>
<tr><td>Log</td><td>X</td><td>Alarm</td><td>X</td><td>Alarm light</td><td>X</td></tr>
<tr><td>Consequence</td><td colspan="6">Not possible to run CA</td></tr>
<tr><td>Elimination</td><td colspan="6">Alarm may be deleted when inactive</td></tr>
<tr><td rowspan="2">Log data</td><td>Parm 1</td><td>Parm 2</td><td>Parm 3</td><td>Parm 4</td><td colspan="2">Parm 5</td></tr>
<tr><td></td><td>0</td><td>0</td><td>0</td><td colspan="2">Err code</td></tr>
</table>

Test alarms (8XX)

826	Hpump current ON				Alarm
Description	Heat vacuum pump too high or too low				
Cause	Measured current is too high or too low when heater is turned on				
Trouble shooting	Possible causes: • Defective cables • Defective heating element • Defective controller module • Defective power meas Accompanied alarms: • N/A Trouble shooting: 1. Check connection according to wiring schematic. 2. Defective heating element, see AL 653. 3. Check supply [Amp] reading and compare with display reading. If reading approx. 10 times normal value, replace controller module				
Criteria	Current < Imin = 0,5*(U/973,2) or current > Imax = 1,5*(U/973,2).				
Controller action	None				
	Log	X	Alarm	X	Alarm light	Slow flash
Consequence	Can not pass PTI				
Elimination	Alarm may be deleted after test complete				
Log data	Parm 1	Parm 2	Parm 3	Parm 4	Parm 5
	Step ID	ILimit	I1	I2	I3

827	Hpump current OFF				Alarm
Description	Current in off position is too high				
Cause	Measured current is too high when heater is turned off				
Trouble shooting	Possible causes: • Mheat controller defective • Defective controller module • Defective contactor Accompanied alarms: • AL 800, AL 812, AL 817, AL 821 and AL 828 may also be active. Trouble shooting: 1. If no accompanied alarms, check contactor K10.				
Criteria	0.5 Amp if off				
Controller action	None				
	Log	X	Alarm	X	Alarm light	Slow flash
Consequence	Can not pass PTI				
Elimination	Alarm may be deleted after test complete				
Log data	Parm 1	Parm 2	Parm 3	Parm 4	Parm 5
	Step ID	I limit	I1	I2	I3

831	Pmem sensor				Alarm
Description	Pmem above or below 1000 mBar (+50/-50) after Mpump off for 300 sec				
Cause	Measure or hardware error				
Trouble shooting	Possible causes: • Pmem defective Accompanied alarms: • AL 211, AL 212, and AL 213 may also be active • AL 214 Trouble shooting: 1. See trouble shooting for accompanied alarms AL 211 and AL 212				
Criteria	Reading out of range. 950 mBar < normal < 1050 mBar				
Controller action	None				
	Log	X	Alarm	X	Alarm light	Slow flash
Consequence	Can not pass PTI				
Elimination	Alarm may be deleted after test complete				
Log data	Parm 1	Parm 2	Parm 3	Parm 4	Parm 5
	Step ID	Airex motor	Pmem	CO2	O2

832	CO2 sensor				Alarm
Description	No reading or value above 1%				
Cause	No communication or defective cable or sensor				
Trouble shooting	Possible causes: • See AL 740 Accompanied alarms: • AL 740 Trouble shooting: 1. See trouble shooting for AL 740.				
Criteria	Reading out of range. Normal range 0-1% CO2				
Controller action	None				
	Log	X	Alarm	X	Alarm light	Slow flash
Consequence	Can not pass PTI				
Elimination	Alarm may be deleted after test complete				
Log data	Parm 1	Parm 2	Parm 3	Parm 4	Parm 5
	Step ID	Airex motor	Pmem	CO2	O2

833	O2 sensor				Alarm
Description	No reading or value is out of range				
Cause	No communication or defective cable or sensor				
Trouble shooting	Possible causes: • See AL 760 Accompanied alarms: • AL 760 Trouble shooting: 1. See trouble shooting for AL 760.				
Criteria	Reading out of range. Normal 19-22 % O2				
Controller action	None				
	Log	X	Alarm	X	Alarm light	Slow flash
Consequence	Can not pass PTI				
Elimination	Alarm may be deleted after test complete				
Log data	Parm 1	Parm 2	Parm 3	Parm 4	Parm 5
	Step ID	Airex motor	Pmem	CO2	O2

834	Mair open					Alarm
Description	Readings for fresh air valve position is outside specified range					
Cause	Current too high					
Trouble shooting	Possible causes: • Damaged or blocked airex module Trouble shooting: 1. Check fresh air module and valves for damages. 2. If valves are open, check connections according to wiring schematic. 3. Disconnect SIGNAL wire at X23 and measure voltage between GND and disconnected SIGNAL wire. If below 1.15 V DC replace controller. 4. Mount SIGNAL wire and test Mair in manual mode, open/close. The value measured should be above 4.15 V DC when closed and below 1.15 V DC when open. If not, replace controller.					
Criteria	Motor potentiometer open 10 - 35 %					
Controller action	None					
	Log	X	Alarm	X	Alarm light	Slow flash
Consequence	Can not pass PTI					
Elimination	Alarm may be deleted after test complete					
Log data	Parm 1	Parm 2	Parm 3	Parm 4	Parm 5	
	Step ID	Airex motor	Pmem	CO2	O2	

835	Mair closed					Alarm
Description	Readings for fresh air valve position is outside specified range					
Cause	Current too high					
Trouble shooting	Possible causes: • Damaged or blocked airex module Trouble shooting: 1. Check fresh air module and valves for damages. 2. If valves are open, check connections according to wiring schematic. 3. Disconnect SIGNAL wire at X23 and measure voltage between GND and disconnected SIGNAL wire. If above 4.15 V DC replace controller. 4. Mount SIGNAL wire and test Mair in manual mode, open/close. The value measured should be above 4.15 V DC when closed and below 1.15 V DC when open. If not, replace controller.					
Criteria	Motor potentiometer closed 70 - 95 %					
Controller action	None					
	Log	X	Alarm	X	Alarm light	Slow flash
Consequence	Can not pass PTI					
Elimination	Alarm may be deleted after test complete					
Log data	Parm 1	Parm 2	Parm 3	Parm 4	Parm 5	
	Step ID	Airex motor	Pmem	CO2	O2	

<table>
<tr><th>836</th><th colspan="5">Pmem vacuum</th><th>Alarm</th></tr>
<tr><td>Description</td><td colspan="6">Unable to create vacuum</td></tr>
<tr><td>Cause</td><td colspan="6">Leakage or low performance vacuum pump</td></tr>
<tr><td>Trouble shooting</td><td colspan="6">Possible causes:
• Lack of oil in the vacuum pump
• Pump not running
• Leakage involving membrane, hose and or connections
• Low performance from vacuum pump
Accompanied alarms:
• AL 403, AL 652, AL 654, AL 656 and or AL 838
Trouble shooting:
1. Check if pump is running, if not, see accompanied alarms for trouble shooting first.
2. The vacuum pump is not running.
a) Check if the bi-metallic switch is connected according to the wire schematic X78 (depending on model)
b) Pushing the contactor in the control cabinet, if the pump is then activated replace controller module. If the pump is not running when pushing the contactor, check contactor and vacuum pump.
3. The vacuum pump is running.
a) Perform “Vacuum system test” on page 11</td></tr>
<tr><td>Criteria</td><td colspan="6">Unable to reach 20 mBar < Pmem < 130 mBar</td></tr>
<tr><td rowspan="2">Controller action</td><td colspan="6">None</td></tr>
<tr><td>Log</td><td>X</td><td>Alarm</td><td>X</td><td>Alarm light</td><td>Slow flash</td></tr>
<tr><td>Consequence</td><td colspan="6">Can not pass PTI</td></tr>
<tr><td>Elimination</td><td colspan="6">Alarm may be deleted after test complete</td></tr>
<tr><td rowspan="2">Log data</td><td>Parm 1</td><td>Parm 2</td><td>Parm 3</td><td>Parm 4</td><td colspan="2">Parm 5</td></tr>
<tr><td>Step ID</td><td>Tpump</td><td>Pmem</td><td>CO2</td><td colspan="2">O2</td></tr>
</table>

837	Pmem ambient				Alarm
Description	Not measuring Pmem pressure 1000 mBar (-50/+50 mBar)				
Cause	Actual pressure measurement out of range				
Trouble shooting	Possible causes: • Pmem defective Accompanied alarms: • AL 211, AL 212 and or AL 213 Trouble shooting: 1. See trouble shooting for accompanied alarms.				
Criteria	Unable to reach Pmem. 950 mBar < Pmem < 1050 mBar				
Controller action	None				
	Log	X	Alarm	X	Alarm light	Slow flash
Consequence	Can not pass PTI				
Elimination	Alarm may be deleted after test complete				
Log data	Parm 1	Parm 2	Parm 3	Parm 4	Parm 5
	Step ID	Tpump	Pmem	CO2	O2

838	Mpump ON current				Alarm
Description	Current failure				
Cause	Uses less or more current than specified				
Trouble shooting	Possible causes: • Bad power connection or supply • Jammed or damaged vacuum pump • Low performance from vacuum pump due to lack of oil Accompanied alarms: • AL 654, AL 656 and or AL 836 Trouble shooting: 1. Check oil level. 2. Run pump manually and observe current. If current outside range 0.9 - 1.3 Amp, replace vacuum pump.				
Criteria	Vacuum pump current is outside its limit 0.9 - 1.3 Amp				
Controller action	None				
	Log	X	Alarm	X	Alarm light	Slow flash
Consequence	Can not pass PTI				
Elimination	Alarm may be deleted after test complete				
Log data	Parm 1	Parm 2	Parm 3	Parm 4	Parm 5
	Step ID	Ilimit	I1	I2	I3

<table>
<tr><th>839</th><th colspan="5">Mpump OFF current</th><th>Alarm</th></tr>
<tr><td>Description</td><td colspan="6">Current in off position is too high</td></tr>
<tr><td>Cause</td><td colspan="6">Measured current is too high when vacuum pump is turned off</td></tr>
<tr><td>Trouble shooting</td><td colspan="6">Possible causes:
• Mpump contactor K9 defective
• Defective controller module.
Accompanied alarms:
• AL 800, AL 812, AL 817, AL 821 and AL 828 may also be active
Trouble shooting:
1. If no accompanied alarms, check contactor K9. If K9 is defective, replace.</td></tr>
<tr><td>Criteria</td><td colspan="6">Less than 0.5 Amp</td></tr>
<tr><td rowspan="2">Controller action</td><td colspan="6">None</td></tr>
<tr><td>Log</td><td>X</td><td>Alarm</td><td>X</td><td>Alarm light</td><td>Slow flash</td></tr>
<tr><td>Consequence</td><td colspan="6">Can not pass PTI</td></tr>
<tr><td>Elimination</td><td colspan="6">Alarm may be deleted after test complete</td></tr>
<tr><td rowspan="2">Log data</td><td>Parm 1</td><td>Parm 2</td><td>Parm 3</td><td>Parm 4</td><td colspan="2">Parm 5</td></tr>
<tr><td>Step ID</td><td>Ilimit</td><td>I1</td><td>I2</td><td colspan="2">I3</td></tr>
</table>

<table>
<tr><th>890</th><th colspan="5">PTI Tset 13</th><th>Alarm</th></tr>
<tr><td>Description</td><td colspan="6">PTI 13°C Set Fault</td></tr>
<tr><td>Cause</td><td colspan="6">Indication of insufficient performance</td></tr>
<tr><td>Trouble shooting</td><td colspan="6">Possible causes:
• Doors are open.
• There may not be enough refrigerant in the unit.
• The heaters do not operate correctly.
Accompanied alarms:
• N/A.
Trouble shooting:
1) Verify that the doors are closed.
2) If start temperature was below +5°C, the heaters may be defective. Start the heaters in manual mode and see if the current consumption is higher than 5 A each phase.
3) The unit may be lacking refrigerant. Check if the small red balls in the sight glass in the receiver (receiver tank) are not at the bottom when the unit is turned off.
Search for leaks, repair and charge the unit.</td></tr>
<tr><td>Criteria</td><td colspan="6">Set-point +13°C was not reached within the 3 hour limit</td></tr>
<tr><td rowspan="2">Controller action</td><td colspan="6">None</td></tr>
<tr><td>Log</td><td>X</td><td>Alarm</td><td>X</td><td>Alarm light</td><td>Slow flash</td></tr>
<tr><td>Consequence</td><td colspan="6">Test failed</td></tr>
<tr><td>Elimination</td><td colspan="6">Alarm may then be deleted after test completed</td></tr>
<tr><td rowspan="2">Log data</td><td>Parm 1</td><td>Parm 2</td><td>Parm 3</td><td>Parm 4</td><td colspan="2">Parm 5</td></tr>
<tr><td>Active/Inactive</td><td>Tset</td><td>Tact</td><td>Tevap</td><td colspan="2">Tret</td></tr>
</table>

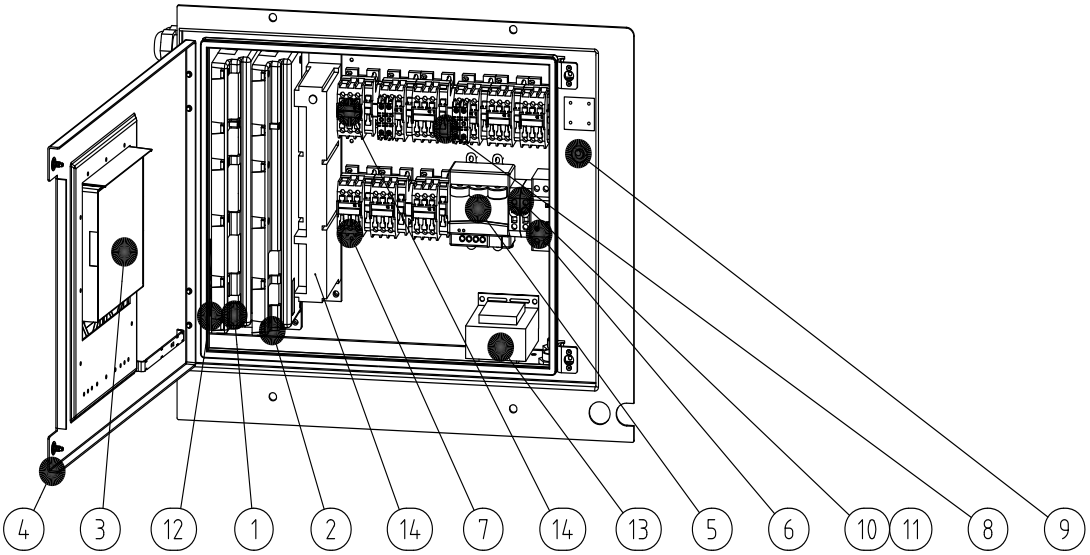
Controller alarms (9XX)

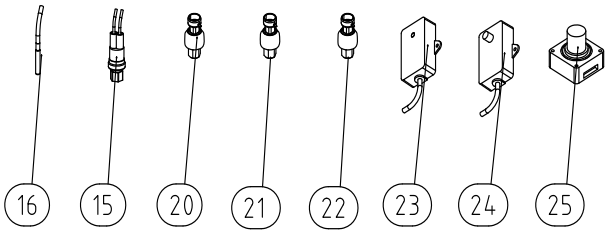
977	Pmem sens sup LOW				Warning
Description	Controller Internal Voltage Reference Fault				
Cause	Sensor voltage supply < 4.50 V				
Trouble shooting	Possible causes: • Controller defective Accompanied alarms: • AL 211, AL 212, AL 213 and or AL 214 Trouble shooting: 1) See Trouble shooting for accompanied alarms				
Criteria	Voltage < 4.50 V DC				
Controller action	None				
	Log	X	Alarm	X	Alarm light	Slow flash
Consequence	Less accurate readings from measurement				
Elimination	Alarm will be marked as inactive in alarm list when supply voltage is correct. Alarm may then be deleted				
Log data	Parm 1	Parm 2	Parm 3	Parm 4	Parm 5
		Low	High	Act	0

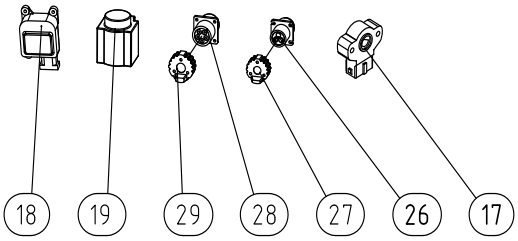
978	Pmem sens sup HIGH					Warning
Description	Controller Internal Voltage Reference Fault					
Cause	Sensor voltage supply > 5.50 V					
Trouble shooting	Possible causes: • Defective power supply for main controller • Defective Pmem pressure transmitter • Defective main controller Accompanied alarms: • AL 213 and or AL 214 Trouble shooting: 1) See Trouble shooting for accompanied alarms					
Criteria	Voltage > 5.50 V DC					
Controller action	None					
	Log	X	Alarm	X	Alarm light	Slow flash
Consequence	Less accurate readings from measurement					
Elimination	Alarm will be marked as inactive in alarm list when supply voltage is correct. Alarm may then be deleted					
Log data	Parm 1	Parm 2	Parm 3	Parm 4	Parm 5	
		Low	High	Act	0	

998	Could not detect CA					Warning
Description	Uanble to detect CA					
Cause	Broken communication					
Trouble shooting	Possible causes: • COMCA cable defective (for some models) • Heating element defective • Contactors defective K10 • Controler module defective Accompanied alarms: • AL 653, AL 740 and or AL 760 Trouble shooting: 1) Check connections according to wire schematic 2) Turn unit off on 3) See Trouble shooting for AL 653					
Criteria	Could not detect CA module in time					
Controller action	Cannot run CA mode					
	Log	X	Alarm	X	Alarm light	Slow flash
Consequence	Can not pass CA PTI					
Elimination	Alarm may be deleted after test complete					
Log data	Parm 1	Parm 2	Parm 3	Parm 4	Parm 5	
		CA mode	CA communi-cation	Idle current sum	Hpump on current sum	

Controller overview







29	Retreiver Socket Cap	2
28	Retreiver Socket	2
27	USDA Socket Cap	4
26	USDA Socket	4
25	Sensor, CO2	1
24	Sensor, O2	1
23	Humidity Sensor, X-HUM digital	1
22	Pressure Transmitter -1-0 Bar	1
21	Pressure Transmitter 0-30 Bar	1
20	Pressure Transmitter -0.69-9.8 Bar	1
19	Solenoid Coil, 10W, 24VAC	3
18	Motor, Fresh Air	1
17	Air Exchange Potentiometer	1
16	Temperature Sensor, 1.8 m	7
15	High Pressure Switch	1
14	RMM Slave Modem, York	1
13	Transformer, 105VA	1
12	Battery Pack	1
11	Fuse, 400mA	2
10	Fuseholder for 0.4A Fuse	2
9	On/Off Switch (incl cable)	1
8	Auxiliary Contact	4
7	Contactor	10
6	Main Circuit Breaker, 16A	1
5	Power Meas Module (SPM100)	1
4	Controller door, Mech. Part	1
3	User Panel (SUP300)	1
2	Controller Module (SSC6-CA, only for some models)	1
1	Controller Module (SMC6XX)	1

Displayed overview may vary depending on model

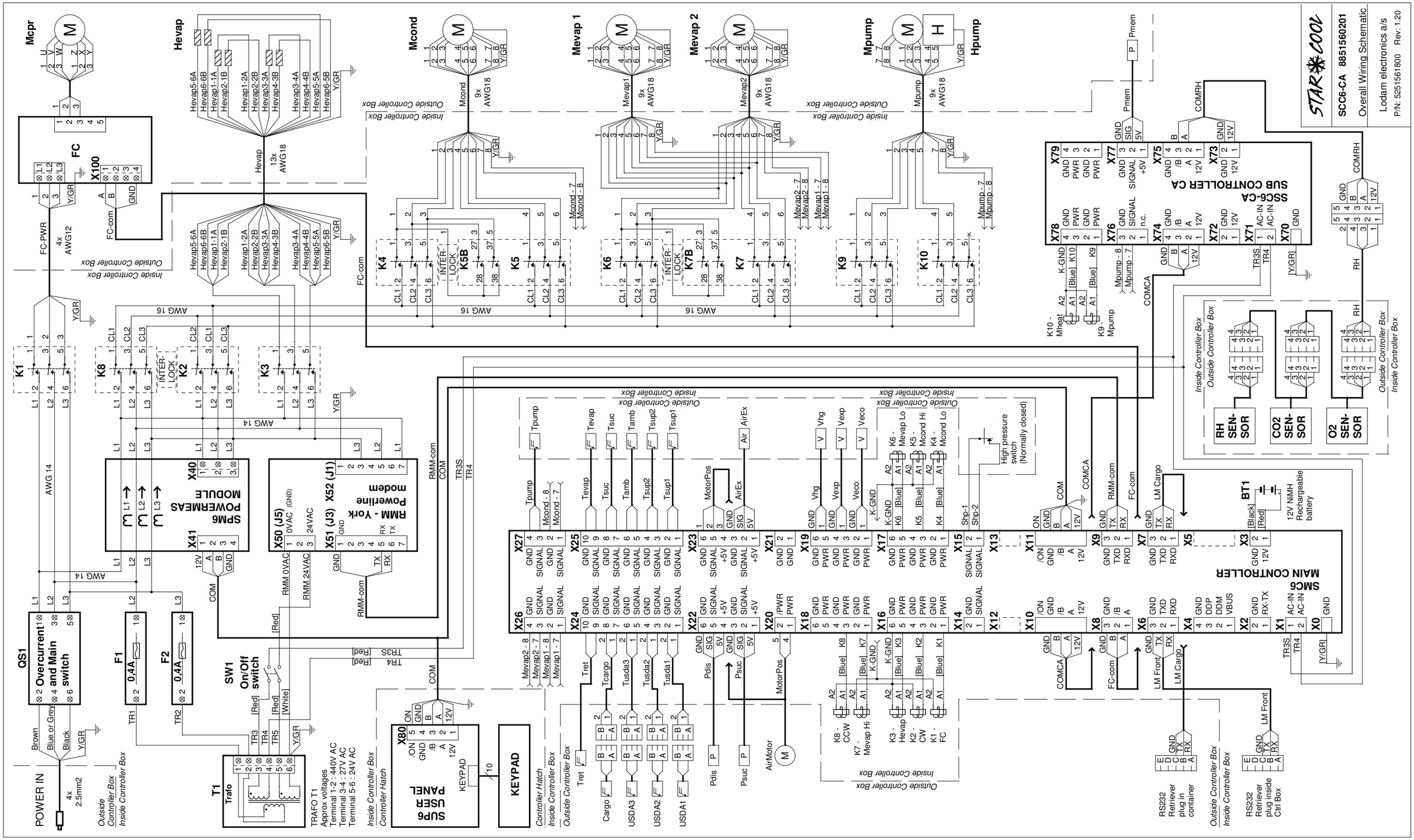
Tables

Vcc = 5V

Voltage [V]	Pressure [Bar]	Pressure [PsiA]	Voltage [V]	Pressure [Bar]	Pressure [PsiA]
0*	0.009	0.13	2.55	0.598	8.67
0.05*	0.021	0.30	2.6	0.610	8.84
0.1*	0.032	0.47	2.65	0.621	9.01
0.15*	0.044	0.63	2.7	0.633	9.18
0.2*	0.055	0.80	2.75	0.644	9.34
0.25*	0.067	0.97	2.8	0.656	9.51
0.3*	0.078	1.14	2.85	0.667	9.68
0.35*	0.090	1.30	2.9	0.679	9.85
0.4*	0.101	1.47	2.95	0.690	10.01
0.45*	0.113	1.64	3	0.702	10.18
0.5	0.125	1.81	3.05	0.714	10.35
0.55	0.136	1.97	3.1	0.725	10.52
0.6	0.148	2.14	3.15	0.737	10.68
0.65	0.159	2.31	3.2	0.748	10.85
0.7	0.171	2.48	3.25	0.760	11.02
0.75	0.182	2.64	3.3	0.771	11.19
0.8	0.194	2.81	3.35	0.783	11.35
0.85	0.205	2.98	3.4	0.794	11.52
0.9	0.217	3.15	3.45	0.806	11.69
0.95	0.228	3.31	3.5	0.818	11.86
1	0.240	3.48	3.55	0.829	12.02
1.05	0.252	3.65	3.6	0.841	12.19
1.1	0.263	3.82	3.65	0.852	12.36
1.15	0.275	3.98	3.7	0.864	12.53
1.2	0.286	4.15	3.75	0.875	12.69
1.25	0.298	4.32	3.8	0.887	12.86
1.3	0.309	4.49	3.85	0.898	13.03
1.35	0.321	4.65	3.9	0.910	13.20
1.4	0.332	4.82	3.95	0.921	13.36
1.45	0.344	4.99	4	0.933	13.53
1.5	0.356	5.16	4.05	0.945	13.70
1.55	0.367	5.32	4.1	0.956	13.87
1.6	0.379	5.49	4.15	0.968	14.03
1.65	0.390	5.66	4.2	0.979	14.20
1.7	0.402	5.83	4.25	0.991	14.37
1.75	0.413	5.99	4.3	1.002	14.54
1.8	0.425	6.16	4.35	1.014	14.70
1.85	0.436	6.33	4.4	1.025	14.87
1.9	0.448	6.50	4.45	1.037	15.04
1.95	0.459	6.66	4.5	1.049	15.21
2	0.471	6.83	4.55*	1.060	15.37
2.05	0.483	7.00	4.6*	1.072	15.54
2.1	0.494	7.17	4.65*	1.083	15.71
2.15	0.506	7.33	4.7*	1.095	15.88
2.2	0.517	7.50	4.75*	1.106	16.04
2.25	0.529	7.67	4.8*	1.118	16.21
2.3	0.540	7.84	4.85*	1.129	16.38
2.35	0.552	8.00	4.9*	1.141	16.55
2.4	0.563	8.17	4.95*	1.152	16.71
2.45	0.575	8.34	5*	1.164	16.88
2.5	0.587	8.51			

* Range with non-reliable readings

Overall wiring schematic



Overall wiring schematic (alternate)